"PRE-OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY USING CLINICAL AND ULTRASONOGRAPHIC PARAMETERS"

Dissertation
Submitted in partial fulfillment of the regulations of

M.S. DEGREE EXAMINATION

BRANCH I GENERAL SURGERY

Department of General Surgery

GOVT. STANLEY MEDICAL COLLEGE AND HOSPITAL

CHENNAI - 600001

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

CHENNAI

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CERTIFICATE

This is to certify that this dissertation titled

"PRE-OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY USING CLINICAL AND ULTRASONOGRAPHIC PARAMETERS"

is the bonafide work done by **Dr Rakesh chandru k,** Post Graduate student (2012 – 2015) in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under my direct guidance and supervision, in partial fulfillment of the regulations of The Tamil Nadu Dr. M.G.R Medical University, Chennai for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2015.

PROF.DR.S.VISWANATHAN ,M S.
Head of the department,
Dept. of General Surgery,
Stanley Medical College,
Chennai-600001.

PROF.DR.M. ABDUL KADER, M S.
Professor of surgery,
Dept of General Surgery
Stanley Medical College,
Chennai-600001.

PROF.DR.A.L.MEENAKSHI SUNDARAM, M D , D A.
The Dean**,**
Stanley Medical College,
Chennai - 600001.

DECLARATION

I, **DR. RAKESH CHANDRU K** .solemnly declare that this dissertation titled "**"PRE-OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY USING CLINICAL AND ULTRASONOGRAPHIC PARAMETERS"**

is a bonafide work done by me in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under the guidance and supervision of my unit chief.

Prof.M. DR.ABDUL KADER, M.S.,
Professor of Surgery

This dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the university regulations for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2015.

Place: Chennai.
Date: September 2014. **DR.RAKESH CHANDRU K**

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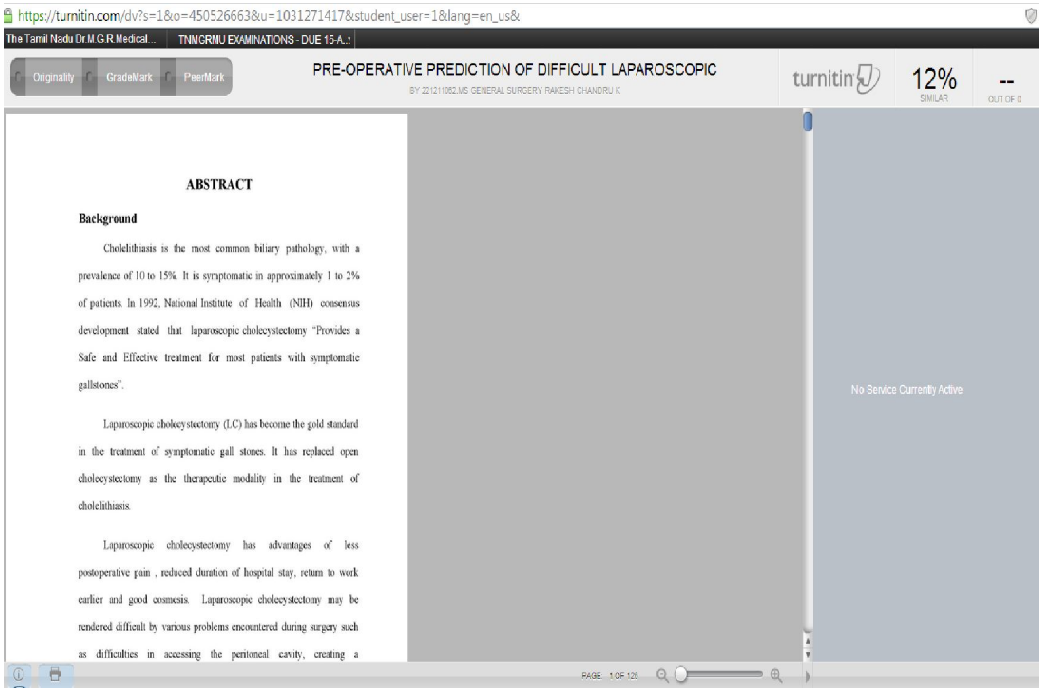
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ABSTRACT
Background
Cholelithiasis is the most common biliary pathology, with a prevalence of 10 to 15%. It is syraptomatic in approximately 1 to 2% of patients. In 1992, National Institute of Health (NIH) consensus development stated that laparoscopic cholecystectomy "Provides a Safe and Effective treatment for most patients with symptomatic gallstones".
Laparoscopic cholecystectomy (LC) has become the gold standard in the treatment of symptomatic gall stones. It has replaced open cholecystectomy as the therapeutic modality in the treatment of cholelithiasis.
Laparoscopic cholecystectomy has advantages of less postoperative pain , reduced duration of hospital stay, return to work earlier and good cosmesis. Laparoscopic cholecystectomy may be rendered difficult by various problems encountered during surgery such as difficulties in accessing the peritoneal cavity, creating a
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INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Pre-Operative prediction of difficult Laparoscopic Cholecystectomy using clinical and Ultrasonographic parameters..

Principal Investigator : Dr. Rakesh Chandru.K

Designation : PG in MS (General Surgery)

Department : Department of General Surgery
Government Stanley Medical College,
Chennai-01

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 02.07.2014 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

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PROFESSOR AND HOD
DEPT. OF PHARMACOLOGY
STANLEY MEDICAL COLLEGE
CHENNAI-600

ABSTRACT

Background

Cholelithiasis is the most common biliary pathology, with a prevalence of 10 to 15%. It is symptomatic in approximately 1 to 2% of patients. In 1992, National Institute of Health (NIH) consensus development stated that laparoscopic cholecystectomy "Provides a Safe and Effective treatment for most patients with symptomatic gallstones".

Laparoscopic cholecystectomy (LC) has become the gold standard in the treatment of symptomatic gall stones. It has replaced open cholecystectomy as the therapeutic modality in the treatment of cholelithiasis.

Laparoscopic cholecystectomy has advantages of less postoperative pain , reduced duration of hospital stay, return to work earlier and good cosmesis. Laparoscopic cholecystectomy may be rendered difficult by various problems encountered during surgery such as difficulties in accessing the peritoneal cavity, creating a pneumoperitoneum, dissecting the gall bladder or extracting the excised gall bladder.

It is important to realize that the need for conversion to laparotomy is neither a failure nor a complication but an attempt to avoid complication and ensure patient safety. Prediction of a difficult LC would allow the surgeon to discuss the likelihood of conversion with the patient and prepare him/her psychologically as well as planning their recovery and explaining their absence from work.

The aim of this study was to predict difficulty of LC and the possibility of conversion to open cholecystectomy (OC) before surgery using the clinical and ultrasonographic criteria.

Objectives of study

1. To determine the predictive factors for difficult laparoscopic cholecystectomy.
2. To study the risks of conversion from laparoscopic to open cholecystectomy.

Methods

The materials for the present study on "PRE-OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY USING CLINICAL AND ULTRASONOGRAPHIC PARAMETERS" comprises of 80 cases admitted to our hospital from September 2013 to August 2014.

The methods for the study included screening of patients who presented with upper abdominal pain, vomiting or dyspepsia. Such patients are studied in detail clinically and investigated as per proforma detailed below. Hematological and biochemical investigations (CBC, RFT, LFT) are done. All patients are subjected to ultrasonographic evaluation

The patients confirmed by USG examination are evaluated with following **factors**: age, sex, BMI (</>30), h/o previous hospitalization, h/o previous abdominal surgeries, h/o acute cholecystitis / pancreatitis.

Sonographic findings: GB wall thickness (>/< 3 mm), pericholecystic collection, number (solitary versus multiple) and liver parenchyma (Normal, fatty infiltration, liver fibrosis).

Following evaluation the patients will be subjected to laparoscopic cholecystectomy and the following **operative parameters** : access to peritoneal cavity (easy/difficult), bleeding during surgery (normal/abnormal), gall bladder bed dissection (easy/difficult), injury to duct/artery, extraction of gall bladder (easy/difficult), or conversion to open surgery are noted.

Analyses of pre operative risk factors, their relation to the dependent factors are performed using -t-test, -chi squared test and significance (p value .05) is demonstrated.

Results would be computed using relevant software (SPSS).

RESULTS

The highest age incidence of cholelithiasis was in the 4^{th} decade, and was more common in females..

Ultrasonography detected gallbladder stones in all patients, wall thickening in 28(35%), pericholecystic collection in 18(22.5) and liver fibrosis in 16(20%).

Laparoscopic cholecystectomy was successfully done in 72 patients. The access to peritoneal cavity was difficult in 22 patients (27.5%), GB bed dissection was difficult in 21 patients (21.3%),

abnormal bleeding occurred in 20 patients (25%) and there was difficulty in extraction of GB in 19 patients (23.8%). Conversion to open surgery occurred in 8 patients(10%).

BMI >32.5, history of cholecystitis, previous abdominal surgery, GB wall thickness>3mm, pericholecystic collection, multiple stones and liver fibrosis were significant predictors of difficult laparoscopic cholecystectomy

There were no significant predictive factors for conversion to open surgery on multivariate analysis in this study.

CONCLUSION

The clinical and ultrasonograpic finding helps to predict a difficult Laparoscopic cholecystectomy. This information may be useful to both the patient and the treating surgeon.

The conversion rate from laparoscopic cholecystectomy to open cholecystectomy was 10% and there were no significant predictive factors on multivariate analysis in this study.

KEY WORDS: LAPAROSCOPIC CHOLECYSTECTOMY, PREDICTIVE FACTORS

LIST OF ABBREVIATIONS

BMI	-Body Mass Index
B. Urea	-Blood Urea
BT	-Bleeding Time
CT	-Clotting Time
CBD	-Common Bile Duct
ERCP	- Endoscopic Retrograde Cholangiopancreatography
ESWL	- Extracorporeal shock Wave Lithotripsy
ECG	-Electrocardiogram
ESR	-Erythrocyte Sedimentation Rate
FBS	-Fasting Blood Sugar
GB	-Gall Bladder
IDA	-Immuno Diacetic Acid
LFT	-Liver Function Test
LC	-Laparoscopic Cholecystectomy
M/C	-Multiple calculi
NP	-Non palpable
N	-Normal
OC	-Open cholecystectomy
IOC	-Intraoperative cholangiography
OCP	-Oral Contraceptives
OCG	-Oral Cholecystography
PTC	-Percutaneous Transhepatic Cholangiography

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INTRODUCTION

Cholelithiasis is the most common biliary pathology. Gallstones are present in 10 to 15% of the general population and asymptomatic in the majority (>80%).

The prevalence of gallstone varies widely in different parts of the world. In India it is estimated to be around 4%. An epidemiological study restricted to rail road workers showed that north Indians have 7 times higher occurrence of gallstones as compared to south Indians.[1] It is estimated that at least 20 million people in the United States have gallstones and that approximately 1 million new cases of cholelithiasis develop each year. Changing incidence in India is mainly attributed to westernization and availability of investigation that is ultrasound in both rural and urban areas and due to change in socioeconomic structure.

Approximately 1-2% of asymptomatic patients will develop symptoms requiring cholecystectomy per year, making cholecystectomy one of the most common operation performed by general surgeons.

Cholelithiasis is rare in the first two decades. Incidence

gradually increases after 21 years and reaches its peak in 5th and 6th decade. Women are more affected than men in the ratio of 4:1.[46]

In 1992, The National Institute of Health (NIH) consensus development conference stated that laparoscopic cholecystectomy "provides a safe and effective treatment for most patients with symptomatic gallstones."

The advantages of laparoscopic cholecystectomy over open cholecystectomy are earlier return to bowel functions, less postoperative pain, informed cosmesis, shorter length of hospital stay, earlier return to full activity, and decreased overall cost.[47,48,49] Laparoscopic cholecystectomy is associated with better preservation of immune function and a reduction of the inflammatory response compared with open surgery. The rate of postoperative infections seems to be lower.[4]

Laparoscopic cholecystectomy has become the gold standard in the treatment of cholelithiasis and is replacing open cholecystectomy. The rate of conversion from laparoscopic cholecystectomy to open cholecystectomy is 5 to 10%. Hence it is necessary to study the predictive factors for difficult laparoscopic cholecystectomy. Therefore this study was undertaken.

AIMS AND OBJECTIVES

1. TO DETERMINE THE PREDICTIVE FACTORS FOR DIFFICULT LAPROSCOPIC CHOLECYSTECTOMY
2. TO STUDY THE RISKS OF CONVERSION FROM LAPAROSCOPIC TO OPEN CHOLECYSTECTOMY

REVIEW OF LITERATURE

HISTORY OF LAPAROSCOPY AND LAPAROSCOPIC CHOLECYSTECTOMY:[64]

Laparoscopy(from the Greek, Laparo meaning the flank and Skopein meaning to examine), was first performed in 1901 by George killing of Dresden, Germany using room air filtered through sterile cotton for pneumoperitoneum and a wide cystoscope to veiw the abdominal cavity of dog.

The use of carbon dioxide (co2) for pneumoperitoneum was first recommended by Richard Zollikofer of Switzerland in 1924.

The primary mode of insufflation was the Veress needle which was introduced by Janos Veress of Hungary in 1938.

In 1929, The German hepatologist Kalk described a dual trocar laparoscopic technique for liver biopsy.

In 1933, A German general surgeon, Feowers, was the first to report laparoscopic lysis of abdominal adhesions for the diagnosis of bowel obstructions.

In 1967, Patrick Steptoe performed laparoscopic tubal ligation and popularized it.

Kurt Semm incorporated new aspects of fiber optic and used automatic gas insufflator which allowed precise controlled intra abdominal pressure.

In 1983, Lukichev and colleagues described laparoscopic cholecystectomy for acute cholecystitis.

In 1985, Muhe of Boblinger, Germany performed the first laparoscopic assisted cholecystectomy.[50]

In 1987, a French surgeon in Lyon, Phillipe Mouret, performed the first video- laparoscopic cholecystectomy.[50]

ANATOMY[54]

The extra-hepatic biliary tree consists of the right and left hepatic ducts, common hepatic duct, cystic duct and gallbladder and the common bile duct.

GALL BLADDER:

The gall bladder is a flask-shaped organ. It is attached to common bile duct by cystic duct. Gall bladder is attached to inferior surface of the right lobe of liver .

Gall bladder is about 7 to 10 cm long and has a capacity of 50 ml in normal adults. It lies in a shallow fossa in liver parenchyma covered by peritoneum continued from the liver surface. This attachment can vary widely. It has no peritoneal covering on the side where attached to liver and on the other side peritoneal covering forms a short mesentry. It has three parts fundus, neck and body.

NECK:

Neck lies close to the porta hepatis at its medial end and it has a short peritoneal cover attached to the liver (MESENTERY); The cystic artery lies witin the mesentry.

The mucosa is obliquely ridged at its medial end forming a spiral groove which is continuous with the spiral valve of the cystic duct. Laterally the neck widens out to form the body of the gall bladder and it is referred as "HARTMANN'S POUCH" the neck lies anterior to the second part of the duodenum.

BODY AND FUNDUS:

The body of the gall bladder normally lies in contact with the liver surface. It lies anterior to the 2^{nd} part of the duodenum and the right end of the transverse colon.

The fundus lies at the lateral end of the body and usually projects past the inferior border of the liver to a variable length. It often lies in contact with the anterior abdominal wall behind the 9^{th} costal cartilage where the lateral edge of the right rectus abdominus crosses the costal margin. This is the location where enlargement of the gall bladder is best sought on clinical examination.

The fundus of gall bladder may be folded back upon the body of gall bladder: PHRYGIAN CAP.

EXTRAHEPATIC BILIARY TREE

CYSYIC DUCT

The cystic duct is about 3 to 4 cm in length, passes posteriorly to the left from the neck of gallbladder, and joins the common hepatic duct to form the common bile duct. It almost runs parallel to it and is adherent to common hepatic duct for a short distance before joining it. The junction usually occurs near the porta hepatis but maybe lower down in the free edge of the lesser Omentum.

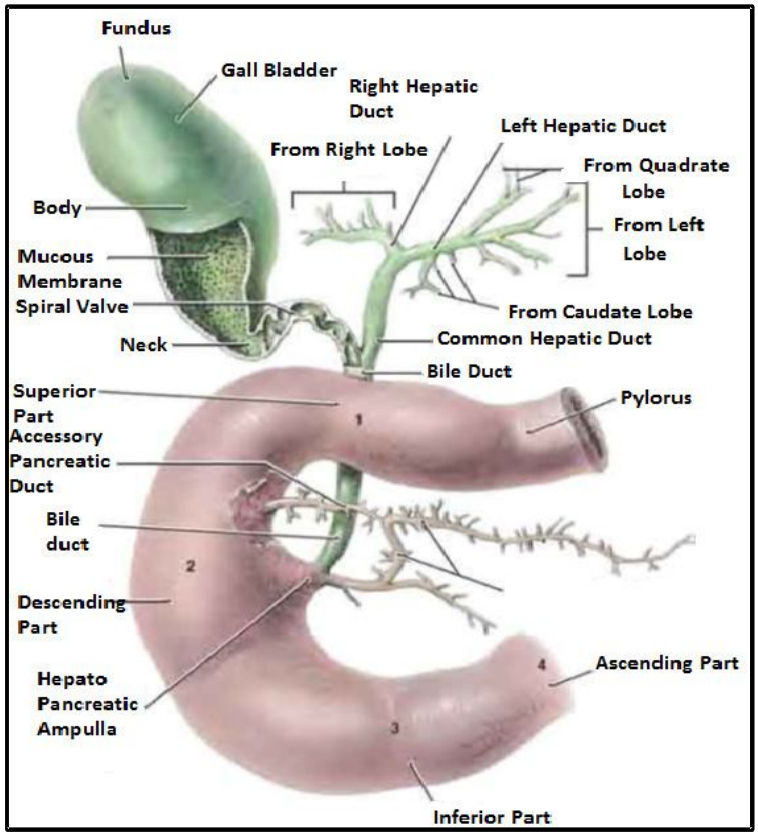


FIGURE 3: showing the anatomy of the gallbladder, biliary radicals, pancreatic duct and the hepatopancreatic ampulla.

HEPATIC DUCTS

The right and left hepatic ducts arises from the liver and joins to form the common hepatic duct near porta hepatis. Common hepatic duct descends for 3 cm and joins with cystic duct to form common bile duct. Hepatic artery is closely associated with common hepatic duct to its left.

COMMON BILE DUCT

It is formed by cystic and common hepatic ducts near porta hepatis. It is about 6 to 8 cm in length and about 6 mm in diameter in adults. It descends posteriorly and to the left, anterior to epiploic foramen, in the right border of lesser omentum. It lies anterior and to the right of portal vein and to the right of the hepatic artery. It lies behind the first part of the duodenum and the gastroduodenal artery lies on its left side. The duct may lie close to the medial wall of the second part of the duodenum or as much as 2 cm from it.

HEPATOPANCREATIC AMPULLA (OF VATER)

It is formed by the union of CBD and pancreatic duct before entering the 2nd part of the duodenum. Circular muscles usually surround the lowermost part of the common bile duct, and frequently also surround the terminal part of the MPD and the ampulla of vater.

CALOT'S TRIANGLE (CHOLECYSTOHEPATIC TRIANGLE)

It is the triangular space bounded by cystic duct, common hepatic duct and the inferior surface of the segment V of the liver. It is enclosed by double layer of peritoneum which forms the short mesentery of the cystic duct; it is perhaps better described as a pyramidal space with one apex lying at the junction of the cystic duct and fundus of the gallbladder, one at the porta hepatis and two closer apices at the attachment of GB to the liver bed.

CONTENTS OF THE CALOT'S TRIANGLE

1) Cystic artery as it approaches the GB.
2) Cystic lymph node.
3) Lymphatics from the GB.
4) 1 or 2 small cystic veins.
5) Autonomic nerves running to the GB.
6) Some adipose tissue.
7) May contain any accessory ducts which drain into GB from liver.

VASCULAR SUPPLY AND LYMPHATIC DRAINAGE CYSTIC ARTERY

The cystic artery commonly arises from the right hepatic artery. It then passes posterior to the common hepatic duct and anterior to the cystic duct to reach the superior aspect of the neck of the gallbladder. It then divides to form superficial and deep branches; superficial branches ramify on the inferior aspect of the gallbladder, the deep branches on the superior aspect. These arteries anastomose over the surface of the body and fundus.

ANATOMICAL VARIATIONS[59]

1) May arise from common hepatic artery, sometimes from the left hepatic artery or rarely from the gastro duodenal or superior mesenteric arteries. In this case it may cross anterior (or less commonly posterior) to CBD or CHD to reach gallbladder.
2) An accessory artery may arise from the common hepatic artery or one of its branches.
3) The cystic artery mostly bifurcates close to its origin to give rise to 2 arteries supplying gallbladder.
4) Multiple fine arterial branches may arise from the parenchyma of the liver (segment IV or V) and contribute to

supply the body particularly when the GB is substantially intrahepatic.

The cystic artery gives rise to multiple fine branches which supply the common and lobar hepatic ducts and the upper part of the CBD.

The common bile duct and hepatic ducts are supplied by a fine network of vessels, which lie in close proximity to the ducts themselves. Disruption of the network during surgical exposure of the bile ducts over a long length frequently causes chronic ischemia and stenosis.

CYSTIC VEINS

Those arising from the superior surface of the body and neck lie in the areolar tissue between the gall bladder and the liver and enter the liver parenchyma to drain into the segmental portal veins. The remainder forms 1 to 2 cystic veins, which enter the liver directly or it joins the veins draining the hepatic ducts and upper bile ducts.

LYMPHATICS

Numerous lymphatic vessels run from the submucosal and subserosal plexuses on all aspects of the gall bladder and cystic duct.

Those on the hepatic aspect of the gallbladder connect with the intrahepatic lymphatics. The remainder drains into the cystic node, which usually lies above the cystic duct in the tissue of Calot's triangle.

This node, and some lymphatic channels which bypass the cystic node, drain into a node lying in the anterior border of the free edge of the lesser Omentum.

INNERVATION

The gall bladder and the extrahepatic biliary tree are innervated by branches from the hepatic plexuses. The retro duodenal part of the CBD also has contribution from the pyloric branches of vagus, which also innervate the smooth muscles of the hepatopancreatic ampulla.

REFERRED PAIN

In common with other structures of foregut origin, pain from stretch of CBD or gallbladder is referred to the central epigastrium. Involvement of overlying somatic peritoneum produces pain which is more localized to the right quadrant.

PHYSIOLOGY

Bile constitutes bile salts, bile pigments and substances in alkaline medium. The daily secretion of bile is about 500 ml.

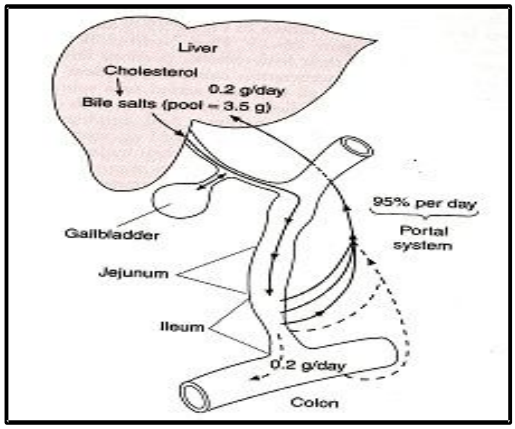
TABLE 1: Composition of hepatic bile

Water Bile salts	97.0% 0.7%
Bile pigments	0.2%
Cholesterol	0.06%
Inorganic salts	0.7%
Fatty acids	0.15%
Lecithin	0.1%
Fat	0.1%
Alkaline phosphatase	-------

Bile acids are formed from cholesterol and include cholic acid and chenodeoxycholic acid. Secondary bile acids are formed in the colon by conversion of cholic acid to deoxycholic acid by gut bacteria. Bile salts are secreted into bile and are conjugated with glycine and taurine.

In small intestine absorption of bile salts takes place by nonionic diffusion with $Na^{+}K^{+}$ATPase and circulated back to liver. This process is called enterohepatic circulation. Some amount of bile salts enter colon and converted to deoxycholic and lithocholic acid and excreted.

About 0.2-0.4gm of bile salts are synthesized per day



Enterohepatic circulation of bile salts

BILIRUBIN METABOLISM AND EXCRETION

Bilirubin is formed from the breakdown of hemoglobin at reticuloendothelial system. In the circulation it is bound to albumin and transported to liver. In the liver conjugation of bilirubin occurs by the enzyme UDP glucuronyl transferase. The conjugated bilirubin is then transported through biliary canaliculi into biliary system. Small amount of this bilirubin escapes into bloodstream and excreted as urobilinogen in urine

The conjugated bilirubin then enters biliary system and its secretion is regulated by sphincter of Oddi. Fatty food and aminoacids when enters duodenum stimulates the secretion of harmone CCK which causes contraction of gall bladder and release of bile. Stimulation of vagus nerve also causes production of bile. The water and bicarbonate content of the bile are increased by harmone secretin. Cholorectics are substances which increase bile secretion.

PATHOGENESIS[58]

CHOLESTROL STONES

Cholesterol is in soluble form with the help of bile salts and lecithin. When cholesterol concentration increases more than that of bile, it forms cholesterol monohydrate crystals, thus forming cholesterol stones.

1) Bile must be supersaturated with cholesterol: When cholesterol is excess, then it penetrates the gall bladder wall and gall bladder hypo motility occurs. This is mainly due to intrinsic neuromuscular dysmotility and decreased response to CCK.
2) Hypo motility of gall bladder initiates nucleation
3) N u c l e a t i o n o f Cholesterol in bile is accelerated due to shift in balance between anti nucleating and pro nucleating proteins and presence of micro precipitates of inorganic or organic calcium salts.
4) Trapping of crystals occurs due to hyper secretion of mucus by GB

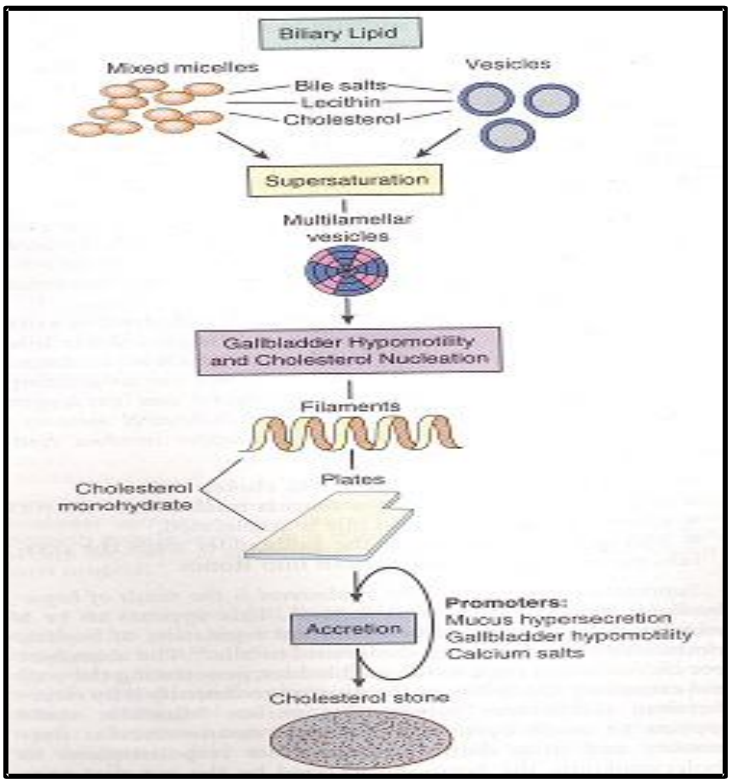


FIGURE 13: Schematic representation of factors contributing cholelithiasis

TABLE 2: Superimposed conditions that exacerbate defective GB emptying and cholesterol stone formation

Prolonged fasting	Total parentral nutrition[53]
Pregnancy[51]	Spinal cord injury
Rapid weight loss[52]	

PIGMENT STONES

Pigment stones composed of insoluble calcium salts of unconjugated bilirubin and inorganic calcium salts. Organisms like Ecoli, ascaris or liver flukes releases beta glucuronidase which hydrolyses bilirubin glucoronides to unconjugated bilirubin. Intravascular hemolysis causes increased secretion of conjugated bilirubin.

BILIARY SLUDGE

It is the mixture of cholesterol crystals, calcium bilirubinate granules, and a mucin gel matrix. It is commonly found in prolonged fasting states or with the use of parenteral nutrition. The finding of molecular complexes of mucin and bilirubin suggests that sludge may serve as the nidus for gallstone pathogenesis.

THE NATURAL HISTORY OF GALLSTONES

In 1992, it was estimated that 10% to 15% of the adult population in the United States had gallstones, which amounted to more than 20 million people (NIH Consensus Statement, 1992). About 1 million patients are newly diagnosed annually, and approximately 600,000 patients underwent cholecystectomy in 1991. Gallstones are the most common digestive disease, leading to hospitalization with an estimated annual cost of $5 billion (NIH Consensus Statement, 1992).

EPIDEMIOLOGY:

Gallstones are most common gastrointestinal illness with a prevalence of 11 to 36% in autopsy reports. Only first degree relatives of the patients with gallstones and obesity (BMI >30 kg/m^2) have been identified as strong risk factors for the development of symptomatic gallstone disease.[6]

TABLE 3: Risk factors for gallstones[7]

Obesity	First degree relatives
Rapid weight loss	Drugs: ceftriaxone, postmenopausal estrogens, total parenteral nutrition
Childbearing	Ethnicity: Native American(Pima Indian)[11], Scandinavian
Multiparity	Ileal disease, resection or bypass
Female sex	Increasing age

CLINICAL PRESENTATION[62]

Most of the patients with gall stones are asymptomatic. Some patients develop symptomatic gallstones with biliary colic. It is caused by the obstruction of cystic duct by the stone. Only 1% to 2% of asymptomatic individuals with gallstones develop serious symptoms or complication related to their gallstones per year; therefore only about 1% require cholecystectomy. Once symptomatic, patients tend to have recurring symptoms, usually repeated episodes of biliary colic.[8]

Nonspecific gastrointestinal symptoms develop in 10 to 30% of patients and 5 to 10% of patients develop classic biliary symptoms.[9]

INVESTIGATIONS[2]

LIVER FUNCTION TEST

Obstructive choledocholithiasis have raised direct bilirubin and elevated alkaline phosphatase levels. Leukocytosis predominantly neutrophils are present in acute cholecystitis and cholangitis.

PT-INR

Prolonged prothombin time is present in liver dysfunction which needs to be normalized before taking to surgery.

ROUTINE BLOOD INVESTIGATIONS

Includes complete haemogram, renal function tests and ECG.

IMAGING STUDIES

PLAIN RADIOGRAPHS

Only about 15% of gallstones contain enough calcium to render them radiopaque and therefore visible on plain abdominal films.

ULTRASONOGRAPHY[63]

An ultrasound is the initial investigation of any patient suspected

of disease of the biliary tree.[56] Abdominal ultrasound is a part of routine evaluation in patients with cholelithiasis and has a sensitivity of >98% and specificity of >95%.[10] In addition to identifying gallstones, ultrasound can also detail signs of cholecystitis such as thickening of the gallbladder wall, pericholecystic fluid, and impacted stone in the neck of the gallbladder. Dilation of the extrahepatic (>10 mm) or intrahepatic (>4mm) bile ducts suggests biliary obstruction.

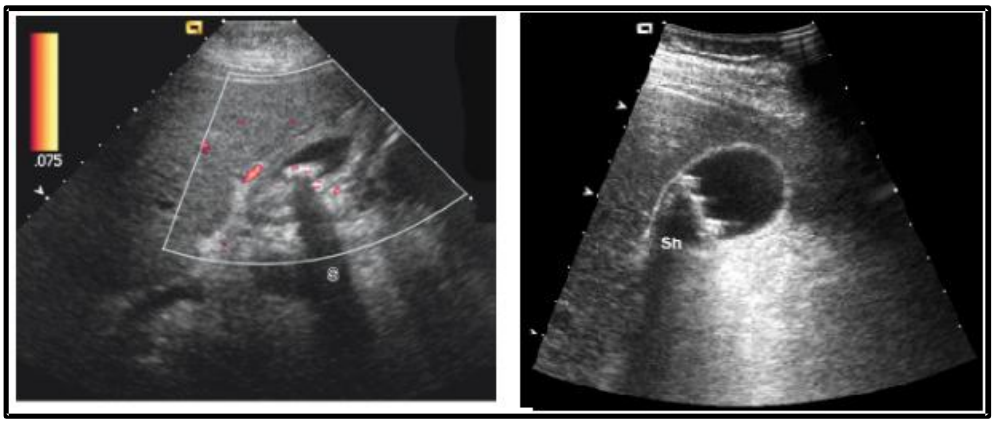


FIGURE 14: A, Echogenic foci in the gallbladder with acoustic shadowing (S) are characteristic of gallstones. In this patient, the gallbladder wall is thickened, but not hyper vascular. Features suggest chronic cholecystitis. B, Multiple stones are layered in the dependent portion of the gallbladder, but the wall is not thickened. Sh, shadow.

ORAL CHOLECYSTOGRAPHY

Identifies filling defects in a visualized, opacified gallbladder

after oral administration of a radioopaque compound that passes into the gallbladder. This procedure is obsolete now.

COMPUTED TOMOGRAPHY

The sensitivity of CT in identifying gall stones is only 55 to 65% This is because both gallstone and bile are isodense and stones are identified only if they are calcified.

SCINTOGRAPHY

Scintography is useful for visualization of biliary tree, assessment of liver and gallbladder function. Nonvisualization of the gallbladder at 2 hours after injection is reliable evidence of cystic duct obstruction. Biliary scintography followed by CCK administration is helpful for documenting biliary dyskinesia when gallbladder contraction accompanies biliary track pain in patients without evidence of stones (CCK hepatobiliary 2,6-dimethyl-iminodiacetic acid(HIDA).

INTRAOPERATIVE CHOLANGIOGRAPHY

The first operative cholangiogram was reported in 1936 by Micken. Mirizzi in 1937 performed the first cystic duct cholangiography.

TECHNIQUES

- Cystic duct cholangiography.
- Gallbladder cholangiography.
- Kumar's technique.

TABLE 4: Indications for routine IOC

Detection of unsuspected CBD stones
To detect anomalous anatomy
Presence of accessory duct
Short cystic duct
Identification of iatrogenic injury

COMPLICATIONS OF GALLSTONES

- Acute cholecystitis
- Chronic calculus cholecystitis
- Choledocholithiasis with or without cholangitis
- Gallstone pancreatitis
- Gallstone ileus
- Gallbladder carcinoma[39]

MANAGEMENT OF CHOLELITHIASIS

The non operative management of gall stones has long fascinated physicians. The idea of dissolving gall stones attracted early interest with Durande in 1782. In 1975, Makino reported gall stone dissolution by administering ursodeoxycholic acid.

EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY (ESWL)[54]

ESWL is in use since 1986. It is used to fragment stones. Patient selection is very crucial for success and is selected according to criteria laid down in Munich study.

The criteria are functioning of gall bladder and stone should be:

i. Cholesterol stone
ii. Less than 3 in number
iii. Less than 3 cm.

Recurrence rate is 5-7% at 12 months and 15% at 24 months.

PREOPERATIVE PREPARATION

1) Blood coagulation should be normalized in patients with prior, by giving vitamin K (IM in 3 doses).
2) A prophylactic antibiotic either with premedication or at the time of anesthesia induction is given. A second generation cephalosporin is appropriate.
3) Subcutaneous heparin or antiembolic stocking are used to prevent deep vein thrombosis.

OPEN CHOLECYSTECTOMY

TABLE 5: Indications for OC
Poor pulmonary or cardiac reserve
Suspected or known gallbladder cancer
Cirrhosis and portal hypertension
Third-trimester pregnancy
Combined procedure
Conversion from laparoscopic approach

A short right upper transverse incision is made centered over the lateral border of the rectus muscle-kocher's incision. The gallbladder is appropriately exposed and packs placed on the hepatic flexure of the colon, the duodenum, and the lesser Omentum to clear view of the anatomy of the porta hepatis. These packs are retracted using the left hand of the assistant, or a stabilized ring retractor is used to keep the pack in position. A duval forceps is placed on the infundibulum of the gallbladder, and the peritoneum overlying calot's triangle is stretched. The calot's triangle is dissected to expose the cystic duct and the cystic artery. These are confirmed by tracing them to enter the gallbladder. The cystic artery is ligated and cut. The cystic duct is then ligated and divided. A suction drain is placed before closure.

When there is doubt about anatomy, a fundus first or retrograde cholecystectomy dissecting on the gallbladder wall down to the cystic duct can be helpful.

LAPAROSCOPIC CHOLECYSTECTOMY[65]

LC is one of the most common surgeries performed and has replaced open cholecystectomy. In 1992, The National Institute of Health (NIH) consensus development conference stated that laparoscopic cholecystectomy "provides a safe and effective treatment for most patients with symptomatic gallstones."[1]

INDICATIONS OF LAPAROSCOPIC CHOLECYSTECTOMY[12]

a) Symptomatic cholelithiasis

   I. Biliary colic: Once the patient experience symptoms, there is a greater than 80% chance that they will continue to have symptoms. There is also a finite risk of disease related complications such as acute cholecystitis, gallstone pancreatitis and choledocholithiasis.

   II. Gallstone pancreatitis.

b) Asymptomatic cholelithiasis

Prophylactic cholecystectomy is recommended in

i. Sickle cell disease: Patients with sickle cell disease often

have hepatic and vasoocclusive crisis that can be difficult to differentiate from acute cholecystitis.[14]

ii. Total parenteral nutrition

iii. Diabetes Mellitus

iv. Chronic immunosuppression

v. No immediate access to health care facilities (eg: missionaries, military personal, peace corps workers, relief workers)

vi. Incidental cholecystectomy for patients undergoing procedures for other indications.

c) Acalculous cholecystitis or biliary dyskinesia[16]

d) Gallbladder polyps >1 cm in diameter.

e) Porcelain gallbladder.

CONTRAINDICATION TO LAPAROSCOPIC CHOLECYSTECTOMY

ABSOLUTE

1) Unable to tolerate general anesthesia.

2) Refractory coagulopathy.

3) Suspicion of carcinoma.

RELATIVE

1. Previous upper abdominal surgery
2. Cholangitis
3. Diffuse peritonitis with hemodynamic compromise
4. Cirrhosis and /or portal hypertension Brittle, friable liver that may be difficult to retract in cephalad direction, associated coagulopathy and due to abnormal portosystemic venous shunts in portal hypertension.
5. Cholecystoenteric fistula
6. Morbid obesity was a contraindication previously due short trocar length and sheath designs making institution of pneumoperitoneum problematic.
7. Chronic obstructive pulmonary disease
8. Pregnancy

Due to unknown effect of co2 on fetus-therefore avoided in first trimester. Open insertion of port or location of initial port in right upper quadrant to avoid damage to uterus. Maintenance of pneumoperitoneum to <12 mm of hg and maternal hyperventilation with monitoring of pco2 is needed to avoid fetal acidosis.

PATIENTS LIKELY TO REQUIRE CONVERSION

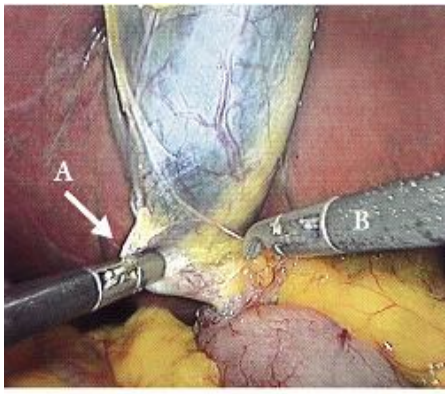
a. Multiple prior operations-due to difficulty in safe access to peritoneal cavity.
b. Acute severe cholecystitis: Due to difficult dissection secondary to inflammation, adhesions or edema.
c. Acute pancreatitis: Difficult visualization of calot's triangle due to edematous pancreatic head.
d. Abnormal anatomy: Higher likelihood of biliary/vascular injury.
e. Cirrhotic liver: Higher likelihood of liver injury and haemorrhage.
f. Third trimester pregnancy: Higher likelihood of uterine injury during access.
g. Morbid obesity: Difficulty in access and dissection.
h. Evidence of generalized peritonitis.
i. Septic shock from cholangitis.

FIGURE 15: Showing steps of laparoscopic cholecystectomy

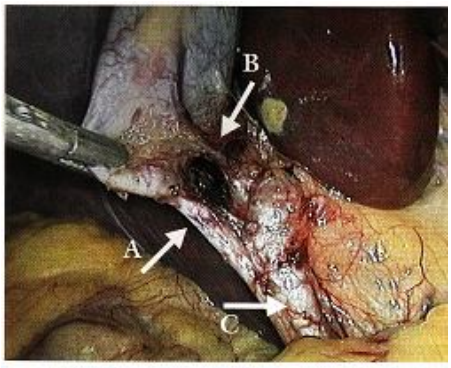
STEP 1: Patient Position

STEP 2: Port Placement

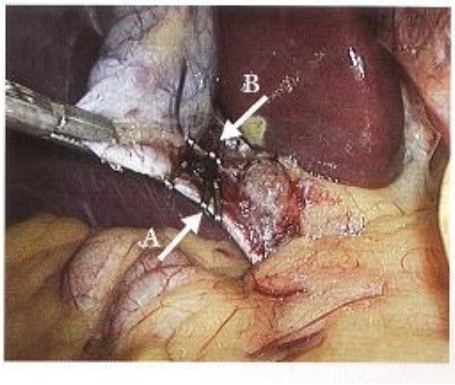
STEP 3: Exposure of Porta Hepatis



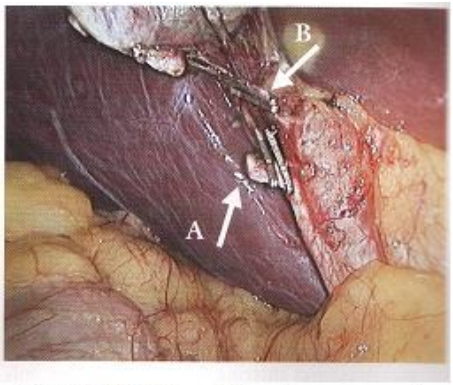
STEP 4 : Dissection of Calot's Triangle



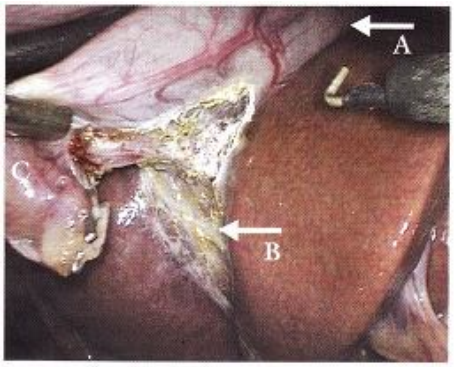
STEP 5: Identification of Cystic Duct(A), Cystic Artery(B) and CBD(C)



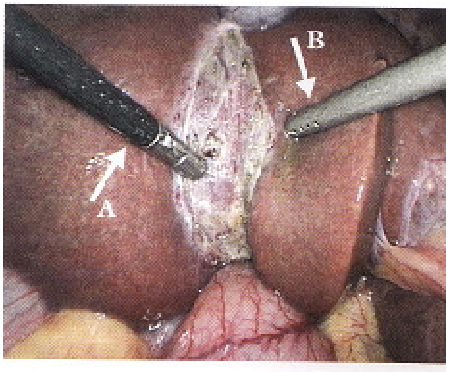
STEP 6: Clipping of Cystic artery and Cystic duct



STEP 7: Division of Cystic artery and Cystic duct



STEP 8: Detachment of GB from the Liver bed



STEP 9: Inspection of Liver bed

STEP 10: Etraction of GB

STEP 11: Extraction of the entire unit

APPROACHES

A) NORTH AMERICAN APPROACH

The patient is kept in supine in anti trendlenburg position(15 degree head up tilt) with left lateral tilt (15-20 degree).this ensures that the bowel and Omentum falls down and medially, away from the operative site. The operating surgeon and camera surgeon stand on the left of the patient while the assistant surgeon stands on the right of the patient. Two monitors are placed at 10'0 and 2'0 clock position.

PORT PLACEMENT

Ports are placed by screwing motion. Second hand is used to prevent inadvertent plunge of the trocar. The assistant should provide counter traction on the abdominal wall during placement of the first trocar. 10 mm port is placed in the midline, usually through the umbilicus. Sub- umbilical position preferred in patients with cirrhosis due to the presence of dilated, tortuous anastomotic veins in the periumbilical region, visceroptic liver, hepatomegaly and in patients with pendulous abdomen.

If a previous abdominal surgery has been performed through a vertical midline incision, abdomen in insufflated through a site

adjacent to the umbilicus, and a primary 5 mm trocar is placed in the right upper quadrant. The 10 mm trocar is then placed under direct vision, avoiding the adhesions from previous operation, under direct vision through a 5 mm telescope passed through 5 mm port.

Pneumoperitoneum is created through Hasson technique if previous surgery prevent primary puncture through the umbilicus.

At the epigastrium, a 10 mm port usually starting from the midline and angling toward the gallbladder, at the level of the inferior edge of the liver and to the right of falciform ligament. If it is placed too high, segment IV of the liver will impede the ability to get to the gallbladder.

A 5 mm trocar is placed 2 to 3 cm below the costal margin in the midclavicular line. The fourth, a 5 mm trocar is generally placed in the anterior axillary line, several centimeters below the fundus of the gallbladder, but its position is variable.

B) FRENCH/EUROPEAN APPROACH

The patient is in semi lithotomy anti trendlenburg position with leg in allen stirrups such that the thighs are almost parallel to the ground. The operating surgeon stands between the legs of the patient

with the camera surgeon on the right of the patient and the assistant on the left of the patient.

PORT PLACEMENT

A camera port is placed at umbilicus, 5 mm epigastric port is placed to allow retraction by assistant, 10 mm right hand working port is placed in left hypochondrium or in the midline between the camera port and the epigastric port and the left hand working port (5 mm) is placed in the right hypochondrium.

ADDITIONAL PORT

a. Left lumbar 5 or 10 mm port for three prong or flat blade retractor for downward traction of the colon, Omentum and duodenum. This maneuver gives wide exposure of the hilum

b. 5 mm port midway between epigastric and right midclavicular ports for lifting the quadrate lobe using blunt tipped retractors (French technique), eg in liver cirrhosis, left lobe gallbladder.

PNEUMIOPERITONEUM

LC is generally performed with a carbondioxide pneumoperitoneum at a pressure of 15 mm of Hg pressure. Other gases like nitrogen oxide, helium and argon are being tried.

TECHNIQUES:

a) VERESS NEEDLE TECHNIQUE

In veress needle technique; pneumoperitoneum is generally created by sliding a veress needle through the umbilicus. The position is confirmed by allowing saline to run through the needle from a plungerless syringe. The needle is then attached to the tubing from carbon dioxide. To ensure proper placement, the initial flow rate should be less than 2l/min .Then a large volume of gas is insufflated. Then look for uniform distention of abdomen so that the needle is confirmed to be intra peritoneal. Also look for tympany and variation of pressure on lifting the abdominal wall .When the initial pressure is greater than 10 mm Hg, suspect retroperitoneal placement of the needle.

Once it is confirmed to be intra-abdominal, the flow rate can be increased until 15 mm Hg of pressure is attained.

b) OPEN - HASSON LAPAROSCOPY TECHNIQUE

In open technique, abdominal cavity is entered through small skin incision and muscle split to enter the peritoneal cavity, the trocar is then inserted. Its position is secured with two stay sutures. The abdominal cavity can then be insufflated with carbon dioxide.

STEPS

A) PATEINT PREPARATION, EQUIPMENT AND

ANAETHESIA EQUIPMENT

1. High-quality video scope with a 300 w light source be coupled to two high- resolution monitors.
2. High-flow carbon dioxide insufflators.
3. Four trocars: 2-10 mm trocars and 2-5 mm trocars.
4. Hand instruments: Monopolar electrode c-hook with suction and irrigation, a fine tipped dissector, two gallbladder grasper, a large gallbladder extractor, a pair of scissors and a medium to large hemoclip applier.
5. 10 mm stone retrieval grasper.
6. Micro scissor, a specialized cholangiogram clamp and a 4 or 5 mm French catheter to perform cholangiogram.

ANAESTHESIA TECHNIQUE

Generally, nitric oxide is avoided to minimize the likelihood of bowel distention. Intravenous fluids must be run frugally as the insensible fluid losses through the closed abdomen are minimized and pneumoperitoneum is a strong stimulator of antidiuretic hormone. End tidal pco2 is monitored to check for hypercarbia and acidosis secondary to carbon dioxide pneumoperitoneum.

Narcotics are used in smaller doses and powerful antiemetic is used to lessen postoperative nausea. Once the patient is anesthetized and intubated, a foley catheter, sequential compression devices and orogastric tube are generally placed. North American approach is generally followed.

B) EXPOSURE OF PORTA HEPATIS

The fundus of the gallbladder is held with a ratchet grasper and retracted by the assistant in a cranial direction, which lifts the right lobe of the liver and exposes the calots triangle and hilum of the liver. Adhesions to the underside of the liver and bladder are carefully taken down beginning near the fundus and proceeding down towards the neck.

C) DISSECTION OF THE CHOLECYSTOHEPATIC TRIANGLE (CALOTS TRIANGLE)

In tensely distended GB, it may be decompressed in two ways- percutaneous verees needle aspiration or the midclavicular trocar is introduced into the fundus of the gallbladder directly and content aspirated.

An atraumatic (dolphin-nosed) non looking grasper is introduced through the left hand working port to hold the infundibulum and retract it downwards and to the right.

Using a Maryland's forceps introduced through the epigastric port, the peritoneum of the infundibulum is held and breached by using small bursts of cautery current. Peritoneum on anterior and posterior aspect is stripped down. The infundibular grasper in moved inferolaterally and superomedially (flag technique) to aid the dissection of anterior and posterior surface of calot's triangle.

D) IDENTIFICATION OF THE CYSTIC DUCT AND ARTERY

Methods for ductal identification in laparoscopic cholecystectomy are

i) Infundibular or infundibular-cystic technique: In this method the cystic duct is isolated by dissection on the front and the back of the triangle of calot's and once isolated it is traced on to the gallbladder. Often this is referred to as seeing a funnel shape ie the gallbladder should be seen to funnel down to terminate in the cystic duct.

ii) Critical view of safety triangle: Described in 1995, this method requires complete dissection of the cholecystohepatic triangle

and separation of the base of the gallbladder infundibulum from the liver bed. When this view is achieved, the two structures entering the gallbladder can only be cystic duct and artery. It is not necessary to see the common bile duct.[17,18]

Cystic duct is identified at the junction of gallbladder (SAFETY ZONE) and followed down for adequate length for cholangiography. It is not necessary to identify and dissect cystic duct CBD junction (DANGER ZONE).

Cystic artery is identified along with its anterior and posterior branches by blunt dissection. The cystic node sometimes overlies the cystic artery.

Both the cystic duct and artery are clipped, two clips on the cystic duct side and one on the gallbladder side. Before clipping the cystic duct the stones in the cystic duct are milked back to GB.

Artery is divided before the duct but in certain cases duct is divided first to give exposure to the artery. In case of an impacted cystic duct stone, the cystic duct is clipped at its junction with GB and a partial cut is made just distal to the clip and impacted stone milked back and extracted.

E) DETACHMENT OF GB FROM THE LIVER BED

The GB can be detached from the liver bed using a spatula with monopolar cautery, hook with monopolar cautery, scissors with monopolar cautery or harmonic scalpel. Care should be taken to stay away from the porta hepatis and the liver bed and to avoid perforation of the gallbladder. Traction and counter traction facilitate dissection.

Any inadvertent spillage of bile or stones from the GB during the procedure should be immediately controlled by applying clips, pre-tied loops or reapplying the grasping clamp. Spilled bile is immediately sucked and stone removed.

Prior to complete detachment of the gallbladder, the liver bed is inspected for adequate hemostasis or bile leak. The cystic duct remnant and cystic artery stumps are examined. Minor oozing from liver bed is controlled with cauterizing and continuous suction irrigation. Once complete hemostasis is achieved GB is separated completely.

F) EXTRACTION OF THE GB

Extraction of the GB can be done through umbilical or epigastric port.

Epigastric port is preferred because:

i) No need to change camera port.

ii) Facilitates thorough rinsing to avoid port tract infection.

iii) By extending skin incision, the fascial opening can be easily dilated and majority of GB extracted.

iv) Fascial opening closed easily by cutaneous approach.

v) Better cosmetic appearance.

A claw shaped gallbladder extraction forceps is introduced and used to grasp the neck of the GB. If GB is too distended, the neck is pulled out through the skin incision, small nick made and bile suctioned and stones crushed using sponge holder.

If the GB is thick preventing its extraction the fascial incision is enlarged using a closed Robert's clamp or extending it.

Infected or necrotic GB or a GB with suspicion of carcinoma is placed in a sterile bag before extraction to reduce port site infection.

G) FINAL INSPECTION AND IRRIGATION

After GB is extracted, the epigastric port is replaced and surgical site inspected for bleeding. A thorough wash is given to the GB bed, Morrison's pouch, paracolic gutter and perihepatic areas with saline

which is later suctioned. Venous ooze is controlled from the liver bed by

i) Gelatin sponge soaked in haemostatic solution. eg: hemlock solution.

ii) Use of harmonic ball application.

iii) Rarely intracorporeal suturing.

iv) Argon plasma coagulator

H) DRAINAGE AND CLOSURE

If drain is needed a 14 F Redivac tube is placed through 5 mm trocar site- lateral most port. Trocars are removed under direct vision to check for bleeding from trocar site. Pneumopritoneum evacuated and 10 mm ports closed with vicryl subcuticular stitch/skin clip/dermabond.

COMPLICATIONS

A) HEMORRHAGE

i) TROCAR SITE BLEEDING

Trocar site bleeding can be prevented by control of bleeding following skin incision and before inserting trocar. Any subcutaneous vessel in subcutaneous tissue should be avoided during insertion.

Detection: the blood may run down the abdominal wall or drip down the instruments into the operative field.

Management: pressure over the site of bleeding by tilting the trocar. Injection of epinephrine 1:10000 in the vicinity of the bleeding site. Screwing in the anchoring device of a disposable trocar may compress and stop the bleeding. Suture ligation.

ii) HEMORRHAGE DUE TO BLUNT DISSECTION OF ADHESIONS can be managed with electrocautery.

iii) SUDDEN AND PULSATILE BLEEDING IN CALOT'S TRIANGLE

Bleeding in the calot's triangle can be prevented by careful dissection and proper application of clip to cystic artery.

Management: Retraction of the GB is released and the GB is gently pushed into the calot's triangle to obtain temporary respite during which additional port is placed between the umbilical and the epigastric ports by repeated suction and irrigation, the blood is cleared from the operative field and the bleeding vessel is precisely identified and clipped.

iv) GALLBLADDER FOSSA BLEEDING

GB fossa bleeding can be controlled by electrocautery, packing the site with hemlock soacked gel foam, figure of eight stitch in case of spurt from liver parenchyma.

b) PERFORATION OF GB

GB perforation seen in acute cholecystitis and while detaching GB from the liver bed. This can be prevented by confining to the areolar tissue between the GB and the liver bed during dissection and decompression of the gall bladder if distended.

TABLE 6: Clinical presentation secondary to gallstone spillage

INFECTIVE	CUTANEOUS	MECHANICAL
Liver abscess	Sinus	Intestinal obstruction
Retrohepatic abscess	Port tract infection	
Subhepatic abscess	Granuloma formation	
Retroperitoneal abscess	Colocutaneous fistula	
Loin abscess		
Pelvic abscess		

Management: Copious irrigation and suction will remove majority of small stones while larger ones are removed using laparoscopic tissue pouch. Drainage catheter is placed. Perforated site must be closed with pre tied ligature or by holding with the grasper.

c) DIFFICULTY IN EXTRACTION OF THE GALLBLADDER

Difficulty in extraction of the gallbladder is seen in gallbladder containing large stones and those with thick wall. In GB containing large stones, the GB is placed in an endobag, the neck retrieved out through the abdomen and stones are crushed and removed. In GB with thickened wall, the GB is placed in an endobag and extracted.

d) OCCULT CARCINOMA

In cases suspected to have carcinoma intra operatively, frozen section is sent and if frozen section is positive for carcinoma, then conversion to open technique is considered and radical surgery with excision of port sites done.

e) POST OPERATIVE BILE LEAK

Post operative bile leak is commonly due to injury to CBD, the right hepatic duct or accessory bile duct.

Postoperative bile leak should be suspected in patients with fever, tachycardia and upper abdominal pain and tenderness persisting or appearing unexpectedly. The diagnosis can be confirmed by USG or ERCP.

If drain is placed most of the minor leak will heal with expectant management.

In some persistent cases, it may be advisable to decrease the intraductal pressure by nasobiliary drainage, endoscopic spincterotomy or transpapillary stenting.

f) BILE DUCT INJURY

Incidence of CBD injury during LC exceeds that of open cholecystectomy ie 0.5% vs 0.2%.[21] Reasons for the increase in injury during LC included loss of information, incorrect traction forces to the gallbladder, and injudicious use of cautery inside of the triangle of calot. Risk factors that increase the risk of CBD injury include acute cholecystitis, aberrant anatomy. The most common anatomic variant is an aberrant right hepatic duct.

PREVENTION

i) Use a 30 degree laparoscope and high-quality imaging equipment.

ii) Apply firm cephalic traction to the fundus and lateral traction to the infundibulum so that the cystic duct is perpendicular to the CBD.

iii) Dissect the cystic duct where it joins the gallbladder.

iv) Expose the "critical view of safety" prior to dividing the cystic duct.[18]

v) Convert to open procedure if the infundibulum cannot be mobilized or bleeding or inflammation obscures the triangle of calot.

vi) Perform routine intraoperative cholangiography. A recent study using an American Medicare database found a reduction in CBD injuries with routine use of IOC (from 0.58% to 0.39%).

g) BOWEL INJURY

Injury to bowel can occur during trocar insertion or dissection in the right upper quadrant, especially when using electrosurgical devices. The jejunum, ileum and colon can be injured by veress needle and trocars while duodenum is likely to be injured during dissection. Any structure fixed to the undersurface of the umbilicus like the

urachus or a meckel's diverticulum is more susceptible to injury during access. The rate of bowel injury between 0 and 0.4% has been reported in various studies.[22] Deziel et al carried out retrospective analysis and found that mortality rate following all bowel injuries during laparoscopic cholecystectomy was 4.6% while it was 8.3% for duodenal injuries.

h) WOUND INFECTION AND INCISIONAL HERNIA

Infection rate following laparoscopic cholecystectomy is less than 1%. Incisional hernia risk is of 0.5%. It can be prevented by using retrieval bag for GB extraction and meticulous port site closure.

i) DIAPHRAGMATIC INJURY

Diaphragmatic injury may be due to either cautery or by mechanical puncture by an instrument while retracting the fundus cranially with excessive force.[24,25]

j) PANCREATITIS

h) PNEUMOPERITONEUM RELATED COMPLICATIONS

It includes carbon dioxide embolism, cardiac arrhythmias, vasovagal reflux and acidosis.

Hypercapnia and acidosis are due to absorption of carbon dioxide from the peritoneal cavity. Sudden increases in $Paco_2$ may be related to port slippage and extra peritoneal or subcutaneous diffusion of co_2. It is managed by desufflating the abdomen for 10 to 15 min. If reinsufflation results in recurrent hypercapnia, then change the insufflations gas or convert to open.

Carbon dioxide embolism is characterized by unexplained hypotension and hypoxia. Characteristic millwheel murmur is detected on auscultation. This is produced due to the contraction of right ventricle against the blood gas interface.

There is an exponential decrease in end tidal co_2 due to complete right ventricular outflow obstruction. It is managed by pnemoperitoneum is immediately let out and placement of the patient in left lateral decubitus, head down (Durant) position.

This allows the co_2 bubble to float to the apex of the right ventricle, where it is less likely to cause right ventricular outflow obstruction. Patient is hyperventilated with 100% oxygen.

ADVANTAGES AND DISADVANTAGES OF LC COMPARED TO OC

TABLE 9: Advantages and disadvantages of lc compared to oc

ADVANTAGES	DISADVANTAGES
Less post operative pain	Lack of depth perception
Smaller incision	View controlled by camera operator
Better cosmesis	More difficult to control hemorrhage
Shorter hospitalization	Decreased tactile discrimination
Earlier return to full activity	Potential co2 insufflation complications
Decreased total costs	Adhesions/inflammation limit use
	Slight increase in bile duct injury

CONVERSION

In 5-10% of cases, conversion to open cholecystectomy may be needed for safe removal of gallbladder; the risk factors for conversion were male sex, obesity, cholecystitis and choledocholithiasis.[26]

RISK FACTORS OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY[67]

i) CLINICAL RISK FACTORS[27]

a) Stocky male patients due to difficulty in initial port placement[34,35]

b) Multiparous women with flabby abdomen due to thinned out lower abdominal musculature the effect of pneumoperitoneum is only in the lower abdomen. Hence there is less space in right hypochondrium to work.

c) Previous upper abdominal surgery[36]

d) Cirrhosis of liver

e) Present or previous acute cholecystitis or acute severe pancreatitis[37]

f) Previous treatment: percutaneous drainage or cholecystostomy

II) ULTRASOUND CRITERIAS

a. Thick walled gallbladder (>3mm)

b. Contracted (nonfunctioning) gallbladder

c. Packed stones and large calcified GB.

d. Polyp or mass lesion without acoustic shadow

e. Evidence of acute cholecystitis:-impacted stones

i. Edematous gallbladder wall

ii. Pericholecystic fluid collection

iii. Air in the gallbladder (emphysematous cholecystitis)

iv. Subphrenic collection

v. Intraperitoneal fluid collection due to perforated GB

f. Fatty liver with hepatomegaly

g. Cirrhosis of liver

h. Portal vein thrombosis with cavernoma

SAFETY MEASURES

a) Selective open technique of pneumoperitoneum

b) Intraoperative cholangiography to identify biliary anatomy and the CBD stones.

c) Laparoscopic ultrasound is useful in mapping biliary and vascular anatomy and is superior to operative cholangiogram.

d) Adequate instrumentation:

i) Toothed graspers to grasp and retract thick walled gallbladder.

ii) Specialized needle drivers and holders

iii) Five pronged retractors.

e) Hydro dissection

f) Preliminary decompression

g) Additional ports for retraction to get adequate exposure

h) Caudal traction of the hepatoduodenal ligament using multipronged retractor. The port is placed in the left mid clavicular line, midway between the camera port and the epigastric port.

i) Dipping retractor for quadrate lobe lifting (French technique)

PROBLEMS IN DIFFICULT CHOLECYSTECTOMY[67]

ACCESS PROBLEMS

a) ADHESIONS

Post-operative adhesions: In lower abdominal scars, the veress needle is inserted at the site of proposed epigastric port. The umbilical port is inserted under visual guidance. In open appendicectomy scar, Hasson method is the ideal technique for creating pneumoperitoneum. In case of upper abdominal scars present in the midline or right Para median position, the left subcostal veress needle insertion (palmer's point) is used to create pneumoperitoneum.

Conversion rate as high as 25% has been reported in patients with extensive upper abdominal adhesions.[28]

Inflammatory adhesions: is usually due to acute cholecystitis or acute severe pancreatitis. These adhesions can easily be removed using suction nozzle. But if the adhesions are organized then sharp dissection is done.

b) INCISIONAL HERNIA

In cases of lower abdominal incisional hernias, appropriate repair could be accomplished after completing laparoscopic cholecystectomy either by open or laparoscopic technique.

c) OBESITY

The veress needle insertion and the insertion of first trocar is difficult. Cystic artery and cystic duct are covered with thick fat hence dissection is difficult.

d) CIRRHOSIS

Due to adhesions with increased vascularity, difficult traction of liver, inadequate exposure of hilum, high risk of GB bleed and high risk hilum.

CONCOMITANT PATHOLOGY

a) MUCOCOELE

Mucocoele is difficult to retract and apply grasping forceps. It is managed by decompression of the GB, using toothed forceps for retraction of GB, removal of the impacted stone either by dislodging into the GB or through an incision over the cystic duct after applying distal clip.

b) GANGRENOUS GB

Due to difficulty in grasping, loss of tissue plane, difficulty in exposure of calot's triangle, performance of intraoperative cholangiogram is difficult, spillage of stones and infected bile; gangrenous GB is difficult to operate.

c) EMPYEMA

d) SCLEROATROPIC GB

The GB is contracted, fibrosed and densely covered with extensive adhesions. Adhesions of the duodenum and the colon are very common and access to calot's triangle is difficult due to fibrous scarring.

e) MIRRIZZI'S SYNDROME

LC is difficult in Mirrizzi's syndrome due to contracted GB with extensive adhesions, CBD may be mistaken for cystic duct and chances of CBD injuries are more and if fistula is not recognized during surgery, biliary peritonitis may occur.

Preoperative ERCP is done in all cases to assess the pathological nature and anatomy of the biliary system.

f) PORCELAIN GB

The prevalence of porcelain GB in cholecystectomy specimen ranges from 0.06% to 0.8%.[30] Decompression of the gallbladder and traction is difficult due to calcified wall. Toothed forceps can be used for cranial traction of the GB.

Calcification of the cystic duct may require endo suturing or application of endoloops to the cystic duct.

g) CHOLECYSTOENTERIC FISTULAS

Cholecystoenteric fistula is an incidental finding in 0.5 to 0.7% of cases of laparoscopic cholecystectomy for biliary disease.[31] The diagnosis suspected by the presence of air in GB. Problems arise

due to difficulty in identification of the anatomy, difficulty in performing cholangiography and due to the requirement of intracorporeal suturing for closure of perforation.

h) ACUTE BILIARY PANCREATITIS

Difficulty in performing LC in acute biliary pancreatitis is due to-extensive adhesions, inflammatory phlegmon at the head of pancreas, edematous cystic duct and hepatoduodenal ligament, presence of ascites, pseudocyst pancreas in retrogastric position.

NEWER APPROACHES IN LAPAROSCOPIC CHOLECYSTECTOMY[65]

a) GASLESS LAPAROSCOPIC CHOLECYSTECTOMY:

Gasless LC is especially useful in patients with cardio respiratory problems.

Here the abdominal wall is lifted mechanically allowing an adequate space for laparoscopic surgery.

b) SPA (SINGLE PORT ACCESS) CHOLECYSTECTOMY.

METHODOLOGY

AIMS & OBJECTIVES

1. TO DETERMINE THE PREDICTIVE FACTORS FOR DIFFICULT LAPROSCOPIC CHOLECYSTECTOMY
2. TO STUDY THE RISKS OF CONVERSION FROM LAPAROSCOPIC TO OPEN CHOLECYSTECTOMY

PLACE OF STUDY

DEPARTMENT OF GENERAL SURGERY - STANLEY MEDICAL COLLEGE & HOSPITAL.

DURATION

SEPTEMBER 2013 TO AUGUST 2014

STUDY DESIGN

PROSPECTIVE STUDY

INCLUSION CRITERIA

PATIENT WHO HAVE BEEN CLINICALLY AND RADIOLOGICALLY (USG Abdomen) DIAGNOSED AS CHOLELITHIASIS AND PLANNED FOR LAPAROSCOPIC CHOLECYSTECTOMY

EXCLUSION CRITERIA

1. PATIENTS BELOW 15 YEARS OF AGE
2. PATIENTS WITH CBD CALCULUS, DILATED CBD WHERE CBD EXPLORATION IS REQUIRED

SAMPLE SIZE: 80

The materials for the present study on "PRE-OPERATIVE PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY USING CLINICAL AND ULTRASONOGRAPHIC PARAMETERS" comprises of 80 cases admitted to our hospital from September 2013 to August 2014.

The methods for the study included screening of patients who presented with upper abdominal pain, vomiting or dyspepsia. Such patients are studied in detail clinically and investigated as per proforma detailed below. Hematological and biochemical investigations (CBC, RFT, LFT) are done. All patients are subjected to ultrasonographic evaluation.

The patients confirmed by USG examination are evaluated with following **factors**: age, sex, BMI, h/o previous hospitalization, h/o previous abdominal surgeries, h/o acute cholecystitis / pancreatitis.

Sonographic findings: GB wall thickness (>/< 3 mm), pericholecystic collection, number (solitary versus multiple) and liver parenchyma (Normal, fatty infiltration, liver fibrosis).

Following evaluation the patients will be subjected to laparoscopic cholecystectomy and the following **operative parameters** : access to peritoneal cavity (easy/difficult), bleeding during surgery (normal/abnormal), gall bladder bed dissection (easy/difficult), injury to duct/artery, extraction of gall bladder (easy/difficult), or conversion to open surgery are noted.

Analyses of pre operative risk factors, their relation to the dependent factors are performed using -t-test, -chi squared test and significance (p value .05) is demonstrated.

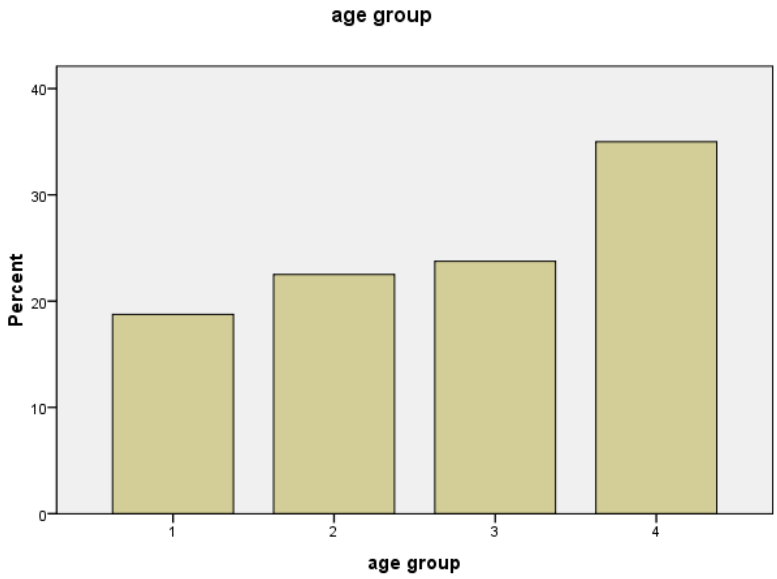
Results would be computed using relevant software (SPSS).

RESULTS

AGE DISTRIBUTION

In the present series majority of the patients were in the age group of 51 to 75 yrs.

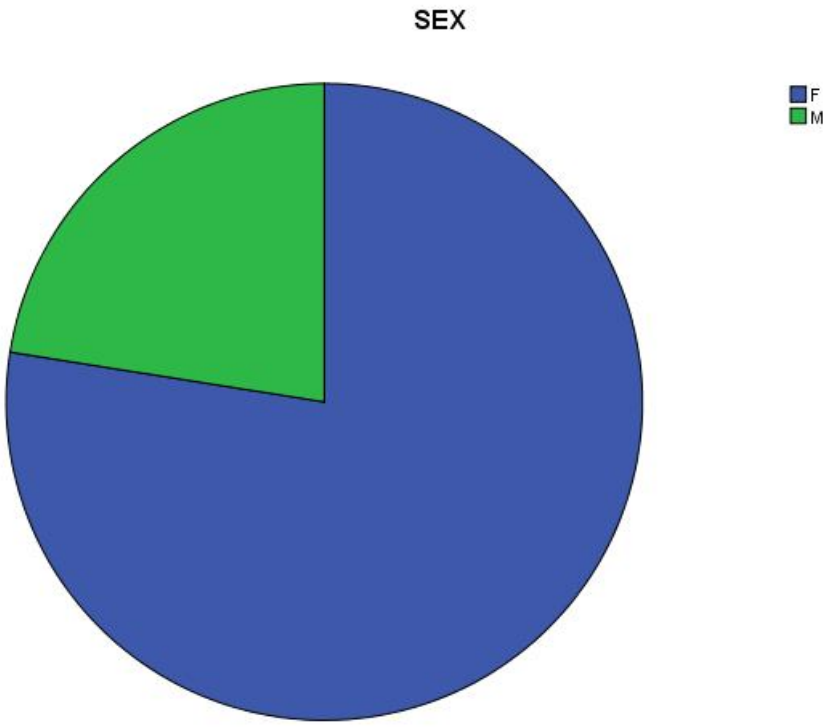
Age group	Frequency	Percent
22-30	15	18.8
31-40	18	22.5
41-50	19	23.8
51-75	28	35.0
Total	80	100.0



SEX DISTRIBUTION

	Frequency	Percent
Females	62	77.5
Males	18	22.5
Total	80	100.0

Among the sample size of 80 patients, 62 were females and 18 were males.



HISTORY OF ACUTE CHOLECYSTITIS

	Frequency	Percent
Absent	57	71.3
Present	23	28.8
Total	80	100.0

23 patients among 80 (28.8%) had history of acute cholecystitis.

HISTORY OF PREVIOUS ABDOMINAL SURGERIES

	Frequency	Percent
Absent	61	76.3
Present	19	23.8
Total	80	100.0

Among 80 patients 19 (23.8%) had previous abdominal surgeries.

ULTRASONOGRAPHY

GB Wall thickness>3mm	28	35%
Pericholecystic collection	18	22.5%
Liver fibrosis	16	20%
Multiple GB stones	47	58.8%

OPERATIVE PARAMETERS

Access to peritoneal cavity	22	27.5%
GB bed dissection	21	21.3%
Abnormal bleeding	20	25%
Difficult extraction of GB	19	23.8%
Conversion to open	8	10%

ANALYSIS OF PRE OPERATIVE FACTORS WITH OPERATIVE PARAMETERS

BODY MASS INDEX

ACCESS TO PERITONEAL CAVITY

	Access to peritoneal cavity	N	Mean	Std. Deviation	Std. Error Mean
BMI	Difficult	22	32.141	2.6565	.5664
	Easy	58	24.136	4.2085	.5526

22 patients had difficulty in access to peritoneal cavity with

mean BMI 32.14 (p value 0.005).

ABNORMAL BLEEDING

Abnormal bleeding		N	Mean	Std. Deviation	Std. Error Mean
BMI	Present	20	28.380	5.7269	1.2806
	Absent	60	25.657	4.9495	.6390

20 patients with mean BMI 28.38 had abnormal bleeding with significant

P value 0.462 .

GALL BLADDER BED DISSECTION

	GB bed dissection	N	Mean	Std. Deviation	Std. Error Mean
BMI	Difficult	21	28.871	5.0580	1.1037
	Easy	59	25.436	5.0604	.6588

21 patients with mean BMI 28.87 had difficulty in GB bed dissection which is not statistically significant P value 0.881.

EXTRACTION OF GALL BLADDER

Extraction of GB		N	Mean	Std. Deviation	Std. Error Mean
BMI	Difficult	19	32.026	2.4271	.5568
	Easy	61	24.566	4.5958	.5884

19 patients with mean BMI of 32.026 had difficulty in extraction of GB with significant P value 0.018.

CONVERSION TO OPEN SURGERY

Conversion to open		N	Mean	Std. Deviation	Std. Error Mean
BMI	Present	8	32.475	2.2257	.7869
	Absent	72	25.656	5.0494	.5951

8 patients with mean BMI OF 32.475 were converted to open surgery with significant P value 0.123.

HISTORY OF ACUTE CHOLECYSTITIS WITH ACCESS TO PERITONEALCAVITY

History of acute cholecystitis			Access to peritoneal cavity		
			Easy	Dufficult	Total
Absent		Count	45	12	57
		% within H/O AC	78.9%	21.1%	100.0%
		% within Ac TO PC	77.6%	54.5%	71.3%
		% of Total	56.3%	15.0%	71.3%
Present		Count	13	10	23
		% within H/O AC	56.5%	43.5%	100.0%
		% within Ac TO PC	22.4%	45.5%	28.8%
		% of Total	16.3%	12.5%	28.8%
	Total	Count	58	22	80
		% within H/O AC	72.5%	27.5%	100.0%
		% within Ac TO PC	100.0%	100.0%	100.0%
		% of Total	72.5%	27.5%	100.0%

Among 23 patients with history of acute cholecystitis, 10 patients had difficulty in access to peritoneal cavity with significant chi square value 4.134, p value 0.042.

HISTORY OF ACUTE CHOLECYSTITIS WITH ABNORMAL BLEEDING

History of acute cholecystitis			Abnormal bleeding		
			Absent	Present	Total
Absent		Count	51	6	57
		% within H/O AC	89.5%	10.5%	100.0%
		% within Bleeding	85.0%	30.0%	71.3%
		% of Total	63.8%	7.5%	71.3%
	Present	Count	9	14	23
		% within H/O AC	39.1%	60.9%	100.0%
		% within Bleeding	15.0%	70.0%	28.8%
		% of Total	11.3%	17.5%	28.8%
	Total	Count	60	20	80
		% within H/O AC	75.0%	25.0%	100.0%
		% within Bleeding	100.0%	100.0%	100.0%
		% of Total	75.0%	25.0%	100.0%

Among 23 patients with history of acute cholecystitis, 14 patients had bleeding with statistical significance chi square value 22.151 and p value .000.

HISTORY OF ACUTE CHOLECYSTITIS WITH GALL BLADDER BED DISSECTION

History of acute cholecystitis			GB bed dissection		
			Easy	Difficult	Total
	Absent	Count	52	5	57
		% within H/O AC	91.2%	8.8%	100.0%
		% within GB bed di	88.1%	23.8%	71.3%
		% of Total	65.0%	6.3%	71.3%
	Present	Count	7	16	23
		% within H/O AC	30.4%	69.6%	100.0%
		% within GB bed di	11.9%	76.2%	28.8%
		% of Total	8.8%	20.0%	28.8%
	Total	Count	59	21	80
		% within H/O AC	73.8%	26.3%	100.0%
		% within GB bed di	100.0%	100.0%	100.0%
		% of Total	73.8%	26.3%	100.0%

Among 23 patients with history of acute cholecystitis,16 patients had difficult gall bladder bed dissection with statistical significance chi square value 31.285 and p value .000 .

HISTORY OF ACUTE CHOLECYSTITIS WITH EXTRACTION OF GALL BLADDER

History of acute cholecystitis		Extraction of GB		
		Easy	Difficult	Total
Absent	Count	48	9	57
	% within H/O AC	84.2%	15.8%	100.0%
	% within Ex of GB	78.7%	47.4%	71.3%
	% of Total	60.0%	11.3%	71.3%
Present	Count	13	10	23
	% within H/O AC	56.5%	43.5%	100.0%
	% within Ex of GB	21.3%	52.6%	28.8%
	% of Total	16.3%	12.5%	28.8%
Total	Count	61	19	80
	% within H/O AC	76.3%	23.8%	100.0%
	% within Ex of GB	100.0%	100.0%	100.0%
	% of Total	76.3%	23.8%	100.0%

Among 23 patients with history of acute cholecystitis, 10 patients had difficult extraction of GB with statistical significant chi square value 6.938 and p value 0.008.

HISTORY OF ACUTE CHOLECYSTITIS WITH CONVERTION TO OPEN SURGERY

History of acute cholecystitis			Conversion to open		
			No	Yes	Total
	Absent	Count	55	2	57
		% within H/O AC	96.5%	3.5%	100.0%
		% within Con to open	76.4%	25.0%	71.3%
		% of Total	68.8%	2.5%	71.3%
	Present	Count	17	6	23
		% within H/O AC	73.9%	26.1%	100.0%
		% within Con to open	23.6%	75.0%	28.8%
		% of Total	21.3%	7.5%	28.8%
	Total	Count	72	8	80
		% within H/O AC	90.0%	10.0%	100.0%
		% within Con to open	100.0%	100.0%	100.0%
		% of Total	90.0%	10.0%	100.0%

Among 23 patients with history of acute cholecystitis, 6 patients were converted to open surgery with statistical significant chi square value 9.282 and p value 0.002.

HISTORY OF PREVIOUS ABDOMINAL SURGERY WITH ACCESS TO PERITONEAL CAVITY

History of previous abdominal surgeries			Access to peritoneal cavity		
			Easy	Difficult	Total
	Absent	Count	48	13	61
		% within H/O PAS	78.7%	21.3%	100.0%
		% within Ac TO PC	82.8%	59.1%	76.3%
		% of Total	60.0%	16.3%	76.3%
	Present	Count	10	9	19
		% within H/O PAS	52.6%	47.4%	100.0%
		% within Ac TO PC	17.2%	40.9%	23.8%
		% of Total	12.5%	11.3%	23.8%
	Total	Count	58	22	80
		% within H/O PAS	72.5%	27.5%	100.0%
		% within Ac TO PC	100.0%	100.0%	100.0%
		% of Total	72.5%	27.5%	100.0%

Among 19 patients with h/o previous abdominal surgery, 9 patients had difficult access to peritoneal cavity with statistical significance chi square value 4.934 and p value 0.026.

HISTORY OF PREVIOUS ABDOMINAL SURGERY WITH ABNORMAL BLEEDING

History of previous abdominal surgeries			Abnormal Bleeding		
			Absent	Present	Total
	Absent	Count	49	12	61
		% within H/O PAS	80.3%	19.7%	100.0%
		% within Bleeding	81.7%	60.0%	76.3%
		% of Total	61.3%	15.0%	76.3%
	Present	Count	11	8	19
		% within H/O PAS	57.9%	42.1%	100.0%
		% within Bleeding	18.3%	40.0%	23.8%
		% of Total	13.8%	10.0%	23.8%
	Total	Count	60	20	80
		% within H/O PAS	75.0%	25.0%	100.0%
		% within Bleeding	100.0%	100.0%	100.0%
		% of Total	75.0%	25.0%	100.0%

Among 19 patients with h/o previous abdominal surgery, 8 patients had abnormal bleeding during surgery with statistical significance chi square value 3.888 and p value 0.049.

HISTORY OF PREVIOUS ABDOMINAL SURGERY WITH GALL BLADDER BED DISSECTION

History of previous abdominal surgeries			GB bed dissection		
			Easy	Difficult	Total
	Absent	Count	50	11	61
		% within H/O PAS	82.0%	18.0%	100.0%
		% within GB bed di	84.7%	52.4%	76.3%
		% of Total	62.5%	13.8%	76.3%
	Present	Count	9	10	19
		% within H/O PAS	47.4%	52.6%	100.0%
		% within GB bed di	15.3%	47.6%	23.8%
		% of Total	11.3%	12.5%	23.8%
	Total	Count	59	21	80
		% within H/O PAS	73.8%	26.3%	100.0%
		% within GB bed di	100.0%	100.0%	100.0%
		% of Total	73.8%	26.3%	100.0%

Among 19 patients with h/o previous abdominal surgeries, 10 patients had difficult GB bed dissection with significant p value 0.003 and chi square value 8.958.

HISTORY OF PREVIOUS ABDOMINAL SURGERY WITH EXTRACTION OF GALL BLADDER

History of previous abdominal surgeries			Extraction of GB		
			Easy	Difficult	Total
	Absent	Count	49	12	61
		% within H/O PAS	80.3%	19.7%	100.0%
		% within Ex of GB	80.3%	63.2%	76.3%
		% of Total	61.3%	15.0%	76.3%
	Present	Count	12	7	19
		% within H/O PAS	63.2%	36.8%	100.0%
		% within Ex of GB	19.7%	36.8%	23.8%
		% of Total	15.0%	8.8%	23.8%
	Total	Count	61	19	80
		% within H/O PAS	76.3%	23.8%	100.0%
		% within Ex of GB	100.0%	100.0%	100.0%
		% of Total	76.3%	23.8%	100.0%

Among 19 patients with h/o previous abdominal surgeries, extraction of GB was difficult in 7 patients which is not statistically significant p value 0.125 chi square value 2.358.

HISTORY OF PREVIOUS ABDOMINAL SURGERY WITH CONVERSION TO OPEN SURGERY

History of previous abdominal surgeries			Conversion to open		
			No	Yes	Total
	Absent	Count	58	3	61
		% within H/O PAS	95.1%	4.9%	100.0%
		% within Con to open	80.6%	37.5%	76.3%
		% of Total	72.5%	3.8%	76.3%
	Present	Count	14	5	19
		% within H/O PAS	73.7%	26.3%	100.0%
		% within Con to open	19.4%	62.5%	23.8%
		% of Total	17.5%	6.3%	23.8%
	Total	Count	72	8	80
		% within H/O PAS	90.0%	10.0%	100.0%
		% within Con to open	100.0%	100.0%	100.0%
		% of Total	90.0%	10.0%	100.0%

Among 19 patients with h/o previous abdominal surgeries, 5 patients were converted to open surgery with significant chi square value 7.370 and p value 0.007.

GALLBLADDER WALL THICKNESS WITH ACCESS TO PERITONEAL CAVITY

GB wall thickness			Access to peritoneal cavity		
			Easy	Difficult	Total
	<3mm	Count	43	9	52
		% within GB WT	82.7%	17.3%	100.0%
		% within Ac TO PC	74.1%	40.9%	65.0%
		% of Total	53.8%	11.3%	65.0%
	>3mm	Count	15	13	28
		% within GB WT	53.6%	46.4%	100.0%
		% within Ac TO PC	25.9%	59.1%	35.0%
		% of Total	18.8%	16.3%	35.0%
	Total	Count	58	22	80
		% within GB WT	72.5%	27.5%	100.0%
		% within Ac TO PC	100.0%	100.0%	100.0%
		% of Total	72.5%	27.5%	100.0%

Among 28 patients with GB wall thickness>3mm, 13 patients had difficulty in access to peritoneal cavity with significant chi square value 7.741 and p value 0.005.

GALLBLADDER WALL THICKNESS WITH ABNORMAL BLEEDING

GB wall thickness			Abnormal Bleeding		
			Absent	Present	Total
	<3mm	Count	49	3	52
		% within GB WT	94.2%	5.8%	100.0%
		% within Bleeding	81.7%	15.0%	65.0%
		% of Total	61.3%	3.8%	65.0%
	>3mm	Count	11	17	28
		% within GB WT	39.3%	60.7%	100.0%
		% within Bleeding	18.3%	85.0%	35.0%
		% of Total	13.8%	21.3%	35.0%
	Total	Count	60	20	80
		% within GB WT	75.0%	25.0%	100.0%
		% within Bleeding	100.0%	100.0%	100.0%
		% of Total	75.0%	25.0%	100.0%

Among 28 patients with GB wall thickness>3mm, 17 patients had abnormal bleeding with significant chi square value 29.304 and p value 0.000.

GALLBLADDER WALL THICKNESS WITH GALL BLADDER BED DISSECTION

GB wall thickness			GB bed dissection		
			Easy	Difficult	Total
	<3mm	Count	50	2	52
		% within GB WT	96.2%	3.8%	100.0%
		% within GB bed di	84.7%	9.5%	65.0%
		% of Total	62.5%	2.5%	65.0%
	>3mm	Count	9	19	28
		% within GB WT	32.1%	67.9%	100.0%
		% within GB bed di	15.3%	90.5%	35.0%
		% of Total	11.3%	23.8%	35.0%
	Total	Count	59	21	80
		% within GB WT	73.8%	26.3%	100.0%
		% within GB bed di	100.0%	100.0%	100.0%
		% of Total	73.8%	26.3%	100.0%

Among 28 patients with GB wall thickness>3mm, 19 patients had difficulty in dissecting GB bed with significant chi square value 38.520 and p value 0.000.

GALLBLADDER WALL THICKNESS WITH EXTRACTION OF GALL BLADDER

GB wall thickness			Extraction of GB		
			Easy	Difficult	Total
	<3mm	Count	46	6	52
		% within GB WT	88.5%	11.5%	100.0%
		% within Ex of GB	75.4%	31.6%	65.0%
		% of Total	57.5%	7.5%	65.0%
	>3mm	Count	15	13	28
		% within GB WT	53.6%	46.4%	100.0%
		% within Ex of GB	24.6%	68.4%	35.0%
		% of Total	18.8%	16.3%	35.0%
	Total	Count	61	19	80
		% within GB WT	76.3%	23.8%	100.0%
		% within Ex of GB	100.0%	100.0%	100.0%
		% of Total	76.3%	23.8%	100.0%

Among 28 patients with GB wall thickness>3mm,13 patients had difficult extraction of GB with significant chi square value 12.234 and p value 0.000.

GALLBLADDER WALL THICKNESS WITH CONVERSION TO OPEN SURGERY

GB wall thickness			Conversion to open		
			No	Yes	Total
	<3mm	Count	51	1	52
		% within GB WT	98.1%	1.9%	100.0%
		% within Con to open	70.8%	12.5%	65.0%
		% of Total	63.8%	1.3%	65.0%
	>3mm	Count	21	7	28
		% within GB WT	75.0%	25.0%	100.0%
		% within Con to open	29.2%	87.5%	35.0%
		% of Total	26.3%	8.8%	35.0%
	Total	Count	72	8	80
		% within GB WT	90.0%	10.0%	100.0%
		% within Con to open	100.0%	100.0%	100.0%
		% of Total	90.0%	10.0%	100.0%

Among 28 patients with GB wall thickness>3mm, 7 patients were converted to open surgery with significant chi square value 10.769 and p value .001.

PERICHOLECYSTIC COLLECTION WITH ACCESS TO PERITONEAL CAVITY

Pericholecystic collection			Access to peritoneal cavity		
			Easy	Difficult	Total
	Absent	Count	49	13	62
		% within PERI C C	79.0%	21.0%	100.0%
		% within Ac TO PC	84.5%	59.1%	77.5%
		% of Total	61.3%	16.3%	77.5%
	Present	Count	9	9	18
		% within PERI C C	50.0%	50.0%	100.0%
		% within Ac TO PC	15.5%	40.9%	22.5%
		% of Total	11.3%	11.3%	22.5%
	Total	Count	58	22	80
		% within PERI C C	72.5%	27.5%	100.0%
		% within Ac TO PC	100.0%	100.0%	100.0%
		% of Total	72.5%	27.5%	100.0%

Among 18 cases with pericholecystic collection, 9 cases had difficulty in access to peritoneal cavity with significant p value 0.015 and chi square value 5.897.

PERICHOLECYSTIC COLLECTION WITH ABNORMAL BLEEDING

Pericholecystic collection			Abnormal Bleeding		
			Absent	Present	Total
	Absent	Count	52	10	62
		% within PERI C C	83.9%	16.1%	100.0%
		% within Bleeding	86.7%	50.0%	77.5%
		% of Total	65.0%	12.5%	77.5%
	Present	Count	8	10	18
		% within PERI C C	44.4%	55.6%	100.0%
		% within Bleeding	13.3%	50.0%	22.5%
		% of Total	10.0%	12.5%	22.5%
	Total	Count	60	20	80
		% within PERI C C	75.0%	25.0%	100.0%
		% within Bleeding	100.0%	100.0%	100.0%
		% of Total	75.0%	25.0%	100.0%

Among 18 cases with pericholecystic collection, 10 cases had abnormal bleeding with significant p value .001 and chi square value 11.565.

PERICHOLECYSTIC COLLECTION WITH GALL BLADDER BED DISSECTION

Pericholecystic collection			GB bed dissection		
			Easy	Difficult	Total
	Absent	Count	54	8	62
		% within PERI C C	87.1%	12.9%	100.0%
		% within GB bed di	91.5%	38.1%	77.5%
		% of Total	67.5%	10.0%	77.5%
	Present	Count	5	13	18
		% within PERI C C	27.8%	72.2%	100.0%
		% within GB bed di	8.5%	61.9%	22.5%
		% of Total	6.3%	16.3%	22.5%
	Total	Count	59	21	80
		% within PERI C C	73.8%	26.3%	100.0%
		% within GB bed di	100.0%	100.0%	100.0%
		% of Total	73.8%	26.3%	100.0%

Among 18 cases with pericholecystic collection, 13 cases had difficulty in dissection from GB bed with significant p value .000 and chi square value 25.355

PERICHOLECYSTIC COLLECTION WITH EXTRACTION OF GALL BLADDER

Pericholecystic collection			Extraction of GB		
			Easy	Difficult	Total
	Absent	Count	51	11	62
		% within PERI C C	82.3%	17.7%	100.0%
		% within Ex of GB	83.6%	57.9%	77.5%
		% of Total	63.8%	13.8%	77.5%
	Present	Count	10	8	18
		% within PERI C C	55.6%	44.4%	100.0%
		% within Ex of GB	16.4%	42.1%	22.5%
		% of Total	12.5%	10.0%	22.5%
	Total	Count	61	19	80
		% within PERI C C	76.3%	23.8%	100.0%
		% within Ex of GB	100.0%	100.0%	100.0%
		% of Total	76.3%	23.8%	100.0%

Among 18 cases with pericholecystic collection, 8 cases had difficulty in extraction of GB with significant p value 0.019 and chi square value 5.493.

PERICHOLECYSTIC COLLECTION WITH CONVERSION TO OPEN SURGERY

Pericholecystic collection			Conversion to open		
			No	Yes	Total
	Absent	Count	60	2	62
		% within PERI C C	96.8%	3.2%	100.0%
		% within Con to open	83.3%	25.0%	77.5%
		% of Total	75.0%	2.5%	77.5%
	Present	Count	12	6	18
		% within PERI C C	66.7%	33.3%	100.0%
		% within Con to open	16.7%	75.0%	22.5%
		% of Total	15.0%	7.5%	22.5%
	Total	Count	72	8	80
		% within PERI C C	90.0%	10.0%	100.0%
		% within Con to open	100.0%	100.0%	100.0%
		% of Total	90.0%	10.0%	100.0%

Among 18 cases with pericholecystic collection, 6 cases were converted to open surgery with significant p value .000 and chi square value 14.05.

NUMBER OF STONES WITH ABNORMAL BLEEDING

No of stones			Abnormal Bleeding		
			Absent	Present	Total
	Solitary	Count	25	7	32
		% within No stones	78.1%	21.9%	100.0%
		% within Bleeding	42.4%	35.0%	40.5%
		% of Total	31.6%	8.9%	40.5%
	Multiple	Count	34	13	47
		% within No stones	72.3%	27.7%	100.0%
		% within Bleeding	57.6%	65.0%	59.5%
		% of Total	43.0%	16.5%	59.5%
	Total	Count	59	20	79
		% within No stones	74.7%	25.3%	100.0%
		% within Bleeding	100.0%	100.0%	100.0%
		% of Total	74.7%	25.3%	100.0%

Among 47 patients with multiple GB stones, 13 had abnormal bleeding which is not statistically significant p value 0.562 and chi square value 0.337.

NUMBER OF STONES WITH GALL BLADDER BED DISSECTION

No of stones			GB bed dissection		
			Easy	Difficult	Total
	solitary	Count	28	4	32
		% within No stones	87.5%	12.5%	100.0%
		% within GB bed di	48.3%	19.0%	40.5%
		% of Total	35.4%	5.1%	40.5%
	Multiple	Count	30	17	47
		% within No stones	63.8%	36.2%	100.0%
		% within GB bed di	51.7%	81.0%	59.5%
		% of Total	38.0%	21.5%	59.5%
	Total	Count	58	21	79
		% within No stones	73.4%	26.6%	100.0%
		% within GB bed di	100.0%	100.0%	100.0%
		% of Total	73.4%	26.6%	100.0%

Among 47 patients with multiple GB stones, 17 had difficulty in dissecting from GB bed with significant p value 0.019 and chi square value 5.466.

NUMBER OF STONES WITH EXTRACTION OF GALL BLADDER

No of stones			Extraction of GB		
			Easy	Difficult	Total
	Solitary	Count	32	0	32
		% within No stones	100.0%	.0%	100.0%
		% within Ex of GB	53.3%	.0%	40.5%
		% of Total	40.5%	.0%	40.5%
	Multiple	Count	28	19	47
		% within No stones	59.6%	40.4%	100.0%
		% within Ex of GB	46.7%	100.0%	59.5%
		% of Total	35.4%	24.1%	59.5%
	Total	Count	60	19	79
		% within No stones	75.9%	24.1%	100.0%
		% within Ex of GB	100.0%	100.0%	100.0%
		% of Total	75.9%	24.1%	100.0%

Among 47 patients with multiple GB stones, 19 had difficulty in extraction of GB with significant p value 0.000 and chi square value 17.033.

NUMBER OF STONES WITH CONVERSION TO OPEN SURGERY

No of stones			Conversion to open		
			No	Yes	Total
	Solitary	Count	32	0	32
		% within No stones	100.0%	.0%	100.0%
		% within Con to open	45.1%	.0%	40.5%
		% of Total	40.5%	.0%	40.5%
	Multiple	Count	39	8	47
		% within No stones	83.0%	17.0%	100.0%
		% within Con to open	54.9%	100.0%	59.5%
		% of Total	49.4%	10.1%	59.5%
	Total	Count	71	8	79
		% within No stones	89.9%	10.1%	100.0%
		% within Con to open	100.0%	100.0%	100.0%
		% of Total	89.9%	10.1%	100.0%

Among 47 patients with multiple GB stones, 8 patients were converted to open surgery with significant p value 0.014 and chi square value 6.061.

LIVER PARENCHYMA WITH ABNORMAL BLEEDING

Liver parenchyma			Abnormal Bleeding		
			Absent	Present	Total
	Normal	Count	54	10	64
		% within LIVER P	84.4%	15.6%	100.0%
		% within Bleeding	90.0%	50.0%	80.0%
		% of Total	67.5%	12.5%	80.0%
	Fibrosis	Count	6	10	16
		% within LIVER P	37.5%	62.5%	100.0%
		% within Bleeding	10.0%	50.0%	20.0%
		% of Total	7.5%	12.5%	20.0%
	Total	Count	60	20	80
		% within LIVER P	75.0%	25.0%	100.0%
		% within Bleeding	100.0%	100.0%	100.0%
		% of Total	75.0%	25.0%	100.0%

Among 16 cases with liver fibrosis, 10 patients had abnormal bleeding with significant p value 0.000 and chi square value 15.0.

LIVER PARENCHYMA WITH GALL BLADDER BED DISSECTION

Liver parenchyma			GB bed dissection		
			Easy	Difficult	Total
	Normal	Count	54	10	64
		% within LIVER P	84.4%	15.6%	100.0%
		% within GB bed di	91.5%	47.6%	80.0%
		% of Total	67.5%	12.5%	80.0%
	Fibrosis	Count	5	11	16
		% within LIVER P	31.3%	68.8%	100.0%
		% within GB bed di	8.5%	52.4%	20.0%
		% of Total	6.3%	13.8%	20.0%
	Total	Count	59	21	80
		% within LIVER P	73.8%	26.3%	100.0%
		% within GB bed di	100.0%	100.0%	100.0%
		% of Total	73.8%	26.3%	100.0%

Among 16 cases with liver fibrosis, 11 had difficulty in dissecting from GB bed with significant p value 0.000 and chi square value 18.660.

LIVER PARENCHYMA WITH CONVERSION TO OPEN SURGERY

Liver parenchyma			Conversion to open		
			No	Yes	Total
	Normal	Count	62	2	64
		% within LIVER P	96.9%	3.1%	100.0%
		% within Con to open	86.1%	25.0%	80.0%
		% of Total	77.5%	2.5%	80.0%
	Fibrosis	Count	10	6	16
		% within LIVER P	62.5%	37.5%	100.0%
		% within Con to open	13.9%	75.0%	20.0%
		% of Total	12.5%	7.5%	20.0%
	Total	Count	72	8	80
		% within LIVER P	90.0%	10.0%	100.0%
		% within Con to open	100.0%	100.0%	100.0%
		% of Total	90.0%	10.0%	100.0%

Among 16 cases with liver fibrosis, 6 cases were converted to open with significant p value .000 and chi square value 16.806.

MULTIVARIATE ANALYSIS OF PRE OPERATIVE FACTORS WITH OPERATIVE PARAMETERS

ACCESS TO PERITONEAL CAVITY

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
BMI	0.74422	0.21970	**0.0007**
H/o Acute cholecystitis	-4.14653	4.54671	0.3618
H/o previous abdominal surgeries	1.16715	1.16251	0.3154
GB wall thickness	0.96133	4.28883	0.8226
Pericholecystic collection	4.71386	2.13492	**0.0272**
No of stones	-2.70217	1.31878	0.0405
Constant	-22.5880		

Odds Ratios and 95% Confidence Intervals

Variable	Odds ratio	95% CI
BMI	**2.1048**	1.3684 to 3.2376
H/o Acute cholecystitis	0.0158	0.0000 to 117.3339
H/o previous abdominal surgeries	3.2128	0.3291 to 31.3644
GB wall thickness	2.6152	0.0006 to 11701.0069
Pericholecystic collection	111.4815	1.6979 to 7319.5328
No of stones	0.0671	0.0051 to 0.8893

Patients with mean BMI >32.14 had difficulty in access to peritoneal cavity with significant p value 0.0007 and there is two times the risk with 95% confidence interval 1.3684 to 3.2376

Patients with pericholecystic collection also had difficult access to peritoneal cavity.

GALL BLADDER BED DISSECTION

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
BMI	0.024628	0.090914	0.7865
H/o Acute cholecystitis	-0.30956	1.20954	0.7980
H/o previous abdominal surgeries	0.85416	0.87392	0.3284
GB wall thickness	3.22078	1.27498	**0.0115**
Pericholecystic collection	0.45260	0.98162	0.6447
AGE	0.064114	0.045921	0.1627
No of stones	-1.20340	1.03997	0.2472
Constant	-6.5256		

Patients with gall bladder thickness > 3mm has difficulty in dissection of gall bladder bed with significant p value – 0.0115

ABNORMAL BLEEDING

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
BMI	-0.021338	0.072076	0.7672
H/o Acute cholecystitis	0.17314	1.23425	0.8884
H/o previous abdominal surgeries	0.010259	0.86733	0.9906
GB wall thickness	3.54691	1.25092	**0.0046**
Pericholecystic collection	-0.79316	1.02064	0.4371
AGE	-0.018261	0.035834	0.6103
Liver parenchyma	1.54511	0.89891	0.0856
Constant	-1.7364		

Patients with gall bladder thickness > 3mm has abnormal bleeding with significant p value – 0.0046

EXTRACTION OF GALL BLADDER

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
BMI	0.55915	0.19443	**0.0040**
H/o Acute cholecystitis	-0.21232	1.48542	0.8863
H/o previous abdominal surgeries	-0.74638	1.16580	0.5220
GB bed dissection	0.17931	1.43269	0.9004
Pericholecystic collection	1.34975	1.61048	0.4020
No of stones	-19.40193	2037.72111	0.9924
AGE	0.016589	0.049923	0.7397
Liver parenchyma	0.46142	1.18533	0.6971
Constant	-17.9753		

Odds Ratios and 95% Confidence Intervals

Variable	Odds ratio	95% CI
BMI	**1.7492**	1.1949 to 2.5606
H/o Acute cholecystitis	0.8087	0.0440 to 14.8665
H/o previous abdominal surgeries	0.4741	0.0483 to 4.6580
GB bed dissection	1.1964	0.0722 to 19.8338
Pericholecystic collection	3.8565	0.1642 to 90.5845
No of stones	0.0000	
AGE	1.0167	0.9220 to 1.1212
Liver parenchyma	1.5863	0.1554 to 16.1944

Patients with mean BMI >32.14 had difficulty in extraction of gall bladder with significant p value of 0.0040 and there is 1.75 times increased risk.

CONVERSION TO OPEN SURGERY

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
BMI	0.61795	0.39833	0.1208
H/o Acute cholecystitis	-18.84746	3128.16667	0.9952
GB bed dissection	28.93112	4463.59784	0.9948
Pericholecystic collection	20.51760	3128.16681	0.9948
AGE	0.030630	0.096844	0.7518
Liver parenchyma	1.80143	1.58980	0.2572
Constant	-51.8186		

Odds Ratios and 95% Confidence Intervals

Variable	Odds ratio	95% CI
BMI	1.8551	0.8498 to 4.0498
H/o Acute cholecystitis	0.0000	
GB bed dissection	3.67E+012	
Pericholecystic collection	814E+006	
AGE	1.0311	0.8528 to 1.2466
Liver parenchyma	6.0583	0.2686 to 136.6517

In present series there are no factors associated with statistically significant conversion to open surgery.

DISCUSSION

AGE DISTRIBUTION

Majority of the patients in the present series were in the age group of 51 to 75 yrs.

SEX DISTRIBUTION

In the present series, out of 80 patients, 62 were females and 18 were males.

PAST HISTORY

Among 80 patients 19 (23.8%) had previous abdominal surgeries,

23 patients among 80 (28.8%) had history of acute cholecystitis.

ULTRASONOGRAPHY

In the present series of 80 patients, GB thickness > 3mm were found in 28 patients(35%) , Pericholecystic collection present in 18 patients(22.5%) , Fibrosis of liver parenchyma present in 16 patients(20%) and 47 patients(58.8%) had multiple GB stones.

OPERATIVE PARAMETERS

Among 80 patients, there was difficulty in access to peritoneal cavity for 22 (27.5%) patients, difficult GB bed dissection in 21(26.3%) patients, abnormal bleeding in 20(25%) patients and difficulty in extraction of gall bladder in 19(23.8%) patients. 8 cases were converted to open cholecystectomy.

EVALUATION OF PREDICTIVE FACTORS FOR DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY:

The preoperative parameters BMI, history of cholecystitis, previous abdominal surgery, GB wall thickness, pericholecystic collection, number of stones and liver parenchyma were analyzed with operative parameters. Initially univariate analysis was done and statistically significant factors were found followed by multivariate analysis

BMI

In present series, 22 patients had difficulty in access to peritoneal cavity with mean BMI 32.14, 20 patients with mean BMI 28.38 had abnormal bleeding, 19 patients with mean BMI of 32.026 had difficulty in extraction of GB, and 8 patients with mean BMI OF 32.475 were converted to open surgery.

HISTORY OF ACUTE CHOLECYSTITIS

Among 23 patients with history of acute cholecystitis 10 patients had difficulty in access to peritoneal cavity, 14 patients had bleeding, 16 patients had difficult gall bladder bed dissection, 10 patients had difficult extraction of GB, and 6 patients were converted to open surgery.

HISTORY OF PREVIOUS ABDOMINAL SURGERY

Among 19 patients with h/o previous abdominal surgery 9 patients had difficult access to peritoneal cavity, 8 patients had abnormal bleeding during surgery, 10 patients had difficult GB bed dissection, and 5 patients were converted to open surgery.

GALLBLADDER WALL THICKNESS

Among 28 patients with GB wall thickness>3mm, 13 patients had difficulty in access to peritoneal cavity, 17 patients had abnormal bleeding, 19 patients had difficulty in dissecting GB bed, 13 patients had difficult extraction of GB and 7 patients were converted to open surgery.

PERICHOLECYSTIC COLLECTION

Among 18 cases with pericholecystic collection 9 cases had difficulty in access to peritoneal cavity, 10 cases had abnormal bleeding, 13 cases had difficulty in dissection from GB bed, 8 cases had difficulty in extraction of GB, and 6 cases were converted to open surgery.

NUMBER OF STONES

Among 47 patients with multiple GB stones 17 had difficulty in dissecting from GB bed, 19 had difficulty in extraction of GB, 8 patients were converted to open surgery.

LIVER PARENCHYMA

Among 16 cases with liver fibrosis 10 patients had abnormal bleeding, 11 had difficulty in dissecting from GB bed, and 6 cases were converted to open surgery.

MULTIVARIATE ANALYSIS

Patients with mean BMI >32.14 had difficulty in access to peritoneal cavity and difficulty in extraction of GB.

Patients with gall bladder thickness > 3mm has difficulty in dissection of gall bladder bed and abnormal bleeding.

CONCLUSSION

- The highest incidence of gallstone in present series is in age group of 51 to 75 years.
- Incidence of gallstones is more in females compared to males
- Ultrasound is the most accurate and sensitive investigation for diagnosis of Cholelithiasis.
- In the present study , BMI >32.5, history of cholecystitis, previous abdominal surgery, GB wall thickness>3mm, pericholecystic collection, multiple stones and liver fibrosis were significant predictors of difficult laparoscopic cholecystectomy
- The conversion rate from laparoscopic cholecystectomy to Open Cholecystectomy was 10% and in the present series on multivariate analysis there are no predictive factors associated with statistically significant conversion to open surgery.

SUMMARY

Cholelithiasis is the most common biliary pathology. Gall stones are present in 10 to 15% of the general population and asymptomatic in the majority of them, of about >80%. Approximately 1-2% of asymptomatic patients will develop symptoms requiring cholecystectomy every year, making it one of the most common operations performed.

In 1992, The National Institute of Health (NIH) consensus development Conference stated that laparoscopic cholecystectomy "Provides a safe and effective treatment for most patients with symptomatic gallstones".

In about 5 to 10% of the cases of laparoscopic cholecystectomy, conversion to open cholecystectomy may be needed for safe removal of gallbladder.

Therefore it is necessary to analyse the risk factors that predict difficult laparoscopic cholecystectomy.

The following risk factors were considered- age>50 years, male sex, H/O prior hospitalization for acute cholecystitis/ biliary pancreatitis, BMI 25-27.5 and >27.5, abdominal scar, palpable GB, wall thickening, impacted stone, and pericholecystic collection. Out of this BMI >32.5, H/O prior hospitalization for acute cholecystitis, H/o previous abdominal surgery, GB wall thickening, and pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy, as per present study.

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PROFORMA

Name:

Age/sex:

IP .NO:

Date of admission:

Date of surgery:

Date of discharge:

PRESENTING COMPLAINTS

PAIN

FLATULENT DYSPEPSIA

NAUSEA AND VOMITING

JAUNDICE

FEVER MASS PER ABDOMEN

BOWEL HABITS

HISTORY OF PRESENTING ILLNESS

PAIN

Site, Duration, Character, Radiation, Relation to food, Aggravating and relieving factors

FLATULENT DYSPEPSIA

Epigastric discomfort, Belching, Heart burn

NAUSEA AND VOMITING

Frequency, Character, Relief after vomiting, Relationship of food

JAUNDICE

Mode of onset, Duration, Progression/painless or painful, High coloured urine, pruritis

APPETITE

FEVER

Intermittent with rigors

MASS PER ABDOMEN

Site, Duration, Association with pain

BOWEL HABITS

Colour of stools, Constipation

PAST HISTORY

H/O similar complaints in the past

H/O acute cholecystitis and previous hospitalization

H/O jaundice

H/O previous surgeries

H/O DM, HTN

PERSONEL HISTORY

Appetite, Sleep, Diet, Bowel/Bladder habits, menstrual history

FAMILY HISTORY

H/O similar complaints in family

GENERAL EXAMINATION

BMI, Pulse, BP, Temperature, Pallor, Icterus, Clubbing, Lymphadenopathy, pedal edema

SYSTEMIC EXAMINATION

CVS, RS, CNS

PER ABDOMEN EXAMINATION

INSPECTION

Contour, movement with respiration, skin, umblicus, any visible swelling

PALPATION

Tenderness, Murphy ‘sign, Palpable mass, Organomegaly

PERCUSSION

Liver dullness and span, shifting dullness

AUSCULTATION

Bowel sounds

PER RECTAL EXAMINATION

INVESTIGATIONS

CBC

BT, CT

RFT

PT-INR

LFT Total bilirubin

Direct bilirubin

SGOT/SGPT

TP/Albumin

ALP

ECG

ULTRASOUND

Stone or sludge

Number and size of stone

Impacted stone

GB wall thickness

Pericholecystic collection

CBD and IHBR, portal vein

Liver parenchyma

DIAGNOSIS:

OPERATIVE DETAILS

Access to peritoneal cavity

Duration of surgery

Bleeding during surgery

Gall bladder bed dissection

Injury to duct/artery

Difficult extraction

Conversion to open surgery

INFORMED CONSENT

Name: Age/ Sex: IP:

I herewith declare that I have been explained in a language fully understood by me regarding the purpose of this study, methodology, proposed intervention, plausible side effects, if any and sequelae.

I have been given an opportunity to discuss my doubts and I have received the appropriate explanation.

I understand that my participation in this study is completely voluntary and that I am free to withdraw from this study at anytime without any prior notice &/ or without having my medical or legal rights affected.

I permit the author and the research team full access to all my records at any point, even if I have withdrawn from the study. However my identity will not be revealed to any third party or publication.

I herewith permit the author and the research team to use the results and conclusions arising from this study for any academic purpose, including but not limited to dissertation/ thesis or publication or presentation in any level.

Therefore, in my full conscience, I give consent to be included in the study and to undergo any investigation or any intervention therein.

Patient's Sign Investigator's Sign